104

[H.N.S.C. No. 104–29]

DEPARTMENT OF ENERGY BUDGET REQUEST FOR FISCAL YEAR 1997

Y 4.SE 2/1 A:995-96/29

Department of Energy Budget Request...

ING

BEFORE THE

MILITARY PROCUREMENT SUBCOMMITTEE

OF THE

COMMITTEE ON NATIONAL SECURITY
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

HEARING HELD
MARCH 12, 1996

DEPOSITORY
MAY 15 1997
BOSTON PUBLIC LIBRARY

[H.N.S.C. No. 104–29]

DEPARTMENT OF ENERGY BUDGET REQUEST FOR FISCAL YEAR 1997

HEARING

BEFORE THE

MILITARY PROCUREMENT SUBCOMMITTEE

OF THE

COMMITTEE ON NATIONAL SECURITY
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

HEARING HELD
MARCH 12, 1996

U.S. GOVERNMENT PRINTING OFFICE
37–346 WASHINGTON : 1997

For sale by the U.S. Government Printing Office
Superintendent of Documents, Congressional Sales Office, Washington, DC 20402
ISBN 0-16-054287-1

MILITARY PROCUREMENT SUBCOMMITTEE

DUNCAN HUNTER, California, *Chairman*

FLOYD SPENCE, South Carolina
BOB STUMP, Arizona
JIM SAXTON, New Jersey
STEVE BUYER, Indiana
PETER G. TORKILDSEN, Massachusetts
JAMES TALENT, Missouri
TERRY EVERETT, Alabama
ROSCOE G. BARTLETT, Maryland
HOWARD "BUCK" McKEON, California
RON LEWIS, Kentucky
J.C. WATTS, JR., Oklahoma
MAC THORNBERRY, Texas
SAXBY CHAMBLISS, Georgia
JAMES B. LONGLEY, JR., Maine

IKE SKELTON, Missouri
RONALD V. DELLUMS, California
NORMAN SISISKY, Virginia
LANE EVANS, Illinois
JOHN TANNER, Tennessee
GENE TAYLOR, Mississippi
NEIL ABERCROMBIE, Hawaii
CHET EDWARDS, Texas
PETE GEREN, Texas
PETE PETERSON, Florida
WILLIAM J. JEFFERSON, Louisiana
ROSA L. DELAURO, Connecticut

STEVE THOMPSON, *Professional Staff Member*
CHRISTOPHER WILLIAMS, *Professional Staff Member*
STEVE ANSLEY, *Professional Staff Member*
KAREN STEUBE, *Staff Assistant*

CONTENTS

STATEMENTS PRESENTED BY MEMBERS OF CONGRESS

Page

Dellums, Hon. Ronald V., a Representative from California, Ranking Minority Member, Committee on National Security: Statement 8

Hunter, Hon. Duncan, a Representative from California, Chairman, Military Procurement Subcommittee:
  Statement 1
  Prepared statement 4

Skelton, Hon. Ike, a Representative from Missouri, Ranking Minority Member, Military Procurement Subcommittee:
  Statement 22
  Prepared statement 23

Spence, Hon. Floyd D. Spence, a Representative from South Carolina, Chairman, Committee on National Security: Statement 8

PRINCIPAL WITNESSES WHO APPEARED IN PERSON OR SUBMITTED WRITTEN STATEMENTS

Curtis, Charles B., Deputy Secretary of Energy, U.S. Department of Energy, accompanied by Greg Rudy, Acting Director, Office of Fissile Materials Disposition, and Terry Lash, Director, Office of Nuclear Energy, U.S. Department of Energy:
  Statement 8
  Prepared statement 12

Hecker, Siegfried S., Director, Los Alamos National Laboratory:
  Statement 96
  Prepared statement 98

Reis, Dr. Victor, Assistant Secretary for Defense Programs, U.S. Department of Energy:
  Statement 24
  Prepared statement 26

Robinson, C. Paul, Director, Sandia National Laboratories:
  Statement 54
  Prepared statement 56

Rohlfing, Joan B., Director, Office of Nonproliferation and National Security, U.S. Department of Energy:
  Statement 44
  Prepared statement 47

Smith, Dr. Harold P., Jr., Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, U.S. Department of Defense:
  Statement 119
  Prepared statement 121

Tarter, C. Bruce, Director, University of California, Lawrence Livermore National Laboratory:
  Statement 67
  Prepared statement 69

DOCUMENTS SUBMITTED FOR THE RECORD

Additional questions and answers submitted for the record 166

Answers to written questions by Dr. C. Paul Robinson, Director, Sandia National Laboratories 382

Attachments A and B, Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement—Summary 264, 327

Page
Department of Energy's Budget Request for FY 1997 362
DOE's Record of Decision on Tritium Supply: Fatal Flaws in the Energy Department's Environmental Impact Statement and Decision Process 392
Employment Impact of DP's Stockpile Stewardship and Management and MD's Materials Storage and Disposition Programmatic Environmental Impact Statements 156
Inertial Confinement Fusion at the University of Rochester by Robert L. McCrory, Professor and Director, Laboratory for Laser Energetics, University of Rochester, Rochester, NY 410
Implementing the North Korean Nuclear Agreement 244
Long-Term Storage Alternatives Fact Sheet 260
Plutonium Disposition Alternatives Fact Sheet 262
Proposed Export of High Performance Computers to Russia 164
Questions and Answers from Hon. Duncan Hunter a Representative from California, Chairman, Military Procurement Subcommittee 166
Written statement submitted by George A. Davis, Project Manager, System 80+ Deployment, U.S. ABB Combustion Engineering Nuclear Systems, Windsor, CT 387

DEPARTMENT OF ENERGY BUDGET REQUEST FOR FISCAL YEAR 1997

House of Representatives,
Committee on National Security,
Military Procurement Subcommittee,
Washington, DC, Tuesday, March 12, 1996.

The subcommittee met, pursuant to notice, at 10:04 a.m., in room 2118, Rayburn House Office Building, Hon. Duncan Hunter (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. DUNCAN HUNTER, A REPRESENTATIVE FROM CALIFORNIA, CHAIRMAN, MILITARY PROCUREMENT SUBCOMMITTEE

Mr. Hunter. The committee will come to order. We meet today to receive testimony on the Department of Energy's budget request for fiscal year 1997 for national security activities, including nuclear weapons activities, nonproliferation, fissile materials disposition, naval reactors, and other programs.

Of particular interest and concern are the Department's plans in the following areas: Tritium production, downsizing of the nuclear weapons design and production complex, and the President's decision to continue the current moratorium on underground U.S. nuclear testing and to seek a so-called zero yield Comprehensive Test Ban Treaty. Allow me to offer some brief comments on each of these topics.

Regarding tritium, I am disappointed to have to report to my colleagues that the United States still does not have a capacity to product tritium, a gas that is needed to ensure the performance of U.S. nuclear weapons. The Department has recently completed a review of tritium production options, but unfortunately, this review did not result in a definitive choice among competing production technologies. Instead, the Department of Energy [DOE] has, in essence, delayed a final decision for another 2 years. This raises serious questions in my mind about whether, in fact, the Department will be able to meet the national requirement to have a new tritium production source online by early in the next decade.

Regarding the size and character of the nuclear weapons design and production complex, DOE has just announced its plans to downsize that complex. This marks at least a partial retreat from earlier plans to consolidate all design and production functions at the three nuclear laboratories and the Nevada test site, although it should be noted that the Department's plans would reduce the size of the complex by four-fifths, as compared to the size of the complex at the height of the cold war.

The Congress expressed its view on this subject last year when both the authorization and appropriations bills added over $100 million to modernize the production infrastructure at the four industrial plants, the Savannah River site, the Pantex plant, the Oak Ridge Reservation, and the Kansas City plant. This morning, we would like to hear how the Department plans to spend these funds.

The Congress last year also asked for a master plan on the actions, time lines, and funding needed to maintain each warhead scheduled to remain in the enduring nuclear weapons stockpile. I am told that this report is in draft form and that progress is being made in coming to terms with how weapons that have in many instances already surpassed their expected lifetimes can be made to last for the indefinite future.

Developing such a plan obviously calls for close collaboration between the Departments of Energy and Defense. We would like to hear more about the status of this report and such collaborative efforts and overall stockpile maintenance efforts more broadly during this morning's session, as well.

Whether DOE ultimately chooses a strategy of mindless downsizing or instead follows a more rational strategy of downsizing and modernizing in place remains to be seen. This is one issue that I know is of great interest to a number of members of this subcommittee.

Finally, let me turn to the issues of nuclear testing and the Comprehensive Test Ban Treaty [CTBT]. The President has already placed his faith in a CTBT which he admits is not verifiable. Here are his words, and I quote. "I recognize that our present monitoring systems will not detect with high confidence very low-yield tests."

But despite this defect, there is an even more fundamental flaw in the President's approach. The cessation of testing will not prevent would-be proliferators from successfully developing a crude nuclear weapon, one that could be used to threaten U.S. troops deployed in a military theater, our friends and allies and coalition partners, or ultimately the American people. We know this from the Pakistan and North Korean examples. Both nations likely possess crude first-generation nuclear weapons and neither conducted a nuclear test in order to achieve such a capability. We now know that Iraq was within months of achieving a nuclear weapon capability, again without having to conduct a single nuclear test.

A zero-yield CTBT would, however, limit U.S. freedom of action in important ways. For example, tests intended to provide confidence that specific fixes to problems identified during routine warhead surveillance would be prohibited. In addition, the United States would be precluded from conducting underground testing to prove out new, safer warhead designs. This could lead to reduced confidence in the U.S. arsenal and, in turn, increased pressures on our friends and allies to pursue their own nuclear weapons programs.

These points were recognized by the Department of Defense and the directors of the nuclear weapons design laboratories, who I am told argued strenuously against a zero-yield CTBT and instead in favor of limited low-yield testing.

Now the President argues "not to worry". Should a problem in the stockpile be detected, he would invoke our supreme national interests rights under CTBT in order to conduct whatever testing might be required. But this promise rings hollow in light of the President's earlier unfulfilled promise that the United States would end its moratorium and resume testing if other nations tested. Since that Presidential promise over 3 years ago, both China and France have conducted numerous tests and press reports suggest that Russia, too, may have conducted a test this past January.

Given these circumstances, it is all the more important to put in place the tools and skills and capabilities needed to sustain the nuclear stockpile. In announcing his decision to pursue a zero-yield CTBT, the President did embrace a so-called Stockpile Stewardship Program. At the moment, however, that program remains a mere promise of a brighter future, and apparently the President's own staff does not share his enthusiasm for maintaining U.S. nuclear competence because the Office of Management and Budget continues to slash funds for stockpile stewardship, apparently unaware of or indifferent to the serious national security implications of such efforts.

All of the above, plus serious concerns that have been raised about Energy Secretary O'Leary's travel habits and spending and seeming inattention to the core business of the Department, namely the nuclear weapons mission, has led some of my colleagues to question whether the Department of Energy is up to the task of assuring U.S. nuclear competence in the post-cold-war era and whether the Department of Defense might be a better home for the nuclear mission. I suspect we may get into a discussion of that issue this morning, as well.

To help us better understand these and other issues, we are delighted to have a distinguished panel of witnesses before the subcommittee. They are Dr. Charles Curtis, Deputy Secretary of Energy; Dr. Vic Reis, a longtime friend and Assistant Secretary of Energy for Defense Programs, and you mentioned, Dr. Reis, you first appeared before us about 7 or 8 years ago in your capacity in Dual-Axis Radiographic Hydrodynamic Test Facility [DARHT]; Ms. Joan Rohlfing, Director of DOE's Office of Nonproliferation and National Security, and, incidentally, a former member of the staff of this committee; Dr. Harold Smith, Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Weapons; Dr. Siegfried Hecker, Director, Los Alamos National Laboratory; Dr. Paul Robinson, President and Director of Sandia National Laboratory; and Dr. Bruce Tarter, Director of Lawrence Livermore National Laboratory. Thanks to each of you for being here today, and to Ms. Rohlfing, welcome back.

Before turning to the witnesses, however, I would like to yield to the distinguished ranking member of the full committee, the gentleman from California, Mr. Dellums, and also then give an opportunity to the chairman of the full committee, Mr. Spence, to make any remarks that he would like to make. Once again, as a subcommittee chair, it is very gratifying and, I think, reflects the importance of these issues that you are both here attending this subcommittee meeting. Thank you for being with us.

[The prepared statement of Mr. Hunter follows:]

OPENING STATEMENT OF REP. DUNCAN HUNTER CHAIRMAN, MILITARY PROCUREMENT SUBCOMMITTEE HEARING ON DEPARTMENT OF ENERGY BUDGET REQUEST

MARCH 12, 1996

We meet today to receive testimony on the Department of Energy's budget request for fiscal year 1997 for national security activities, including nuclear weapons activities, nonproliferation, fissile materials disposition, Naval reactors, and other programs.

Of particular interest and concern are the Department's plans in the following areas: tritium production; down-sizing of the nuclear weapons design and production complex; and the President's decision to continue the current moratorium on underground U.S. nuclear testing and to seek a so-called "zero yield" Comprehensive Test Ban Treaty. Allow me to offer some brief comments on each of these topics.

Regarding tritium, I am disappointed to have to report to my colleagues that the United States still does not have a capacity to produce tritium -- a gas that is needed to ensure the performance of U.S. nuclear weapons. The Department has recently completed a review of tritium production options, but unfortunately this review did not result in a definitive choice among competing production technologies. Instead, the DOE has, in essence, delayed a final decision for another two years. This raises serious questions in my mind about whether in fact the Department will be able to meet the National requirement to have a new tritium production source on-line by early in the next decade.

Regarding the size and character of the nuclear weapons design and production complex, DOE has just announced its plan to "down-size" that complex. This marks at least a partial retreat from earlier plans to consolidate all design and production functions at the three nuclear laboratories and the Nevada Test Site, although it should be noted that the Department's plans would reduce the size of the complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The Congress expressed its view on this subject last year, when both the authorization and appropriations bills added over $100 million to modernize the production infrastructure at the four industrial plants (the Savannah River Site, the Pantex Plant, the Oak Ridge Reservation, and the Kansas City Plant). This morning we'd like to hear how the Department plans to spend those funds.

The Congress last year also asked for a Master Plan on the actions, timelines, and funding needed to maintain each warhead scheduled to remain in the enduring nuclear weapons stockpile. I am told that this report is in draft form and that progress is being made in coming to terms with how weapons that have in many instances already surpassed their expected lifetimes, can be made to last for the indefinite future. Developing such a plan obviously calls for close collaboration between the Departments of Energy and Defense. We'd like to hear more about the status of this report and such collaborative efforts, and overall stockpile maintenance efforts more broadly, during this morning's session as well.

Whether DOE ultimately chooses a strategy of mindless "down-sizing" or instead follows a more rational strategy of "down-sizing *and modernizing* in place" remains to be seen. This is one issue that I know is of great interest to a number of the Members of this Subcommittee.

Finally, let me turn to the issues of nuclear testing and a CTBT. The President has clearly placed his faith in a CTBT which he admits is not verifiable. Here are his words: (quote) "I recognize that our present monitoring systems will not detect with high confidence very low yield tests."

But despite this defect, there is an even more fundamental flaw in the President's approach: The cessation of testing *will not* prevent would-be proliferators from successfully developing a crude nuclear weapon -- one that could be used to threaten U.S. troops deployed in a military theater, our friends and allies and coalition partners, or ultimately the American people. We know this from the Pakistan and North Korean examples. Both nations likely possess crude, first-generation nuclear weapons and neither conducted a nuclear test in order to achieve such a capability. And we now know that Iraq was within months of achieving a nuclear weapon capability, again without having to conduct a single nuclear test.

A zero-yield CTBT would, however, limit U.S. freedom of action in important ways. For example, tests intended to provide confidence that specific "fixes" to problems identified during routine warhead surveillance would be prohibited. In addition, the U.S. would be precluded from conducting underground testing to prove out new, safer warhead designs. This could lead to reduced confidence in the U.S. arsenal and, in turn, increased pressures on our friends and allies to pursue their own nuclear weapons programs.

These points were recognized by the Department of Defense and the directors of the nuclear weapons design laboratories, who I am told argued strenuously against a zero-yield CTBT and instead in favor of limited, low-yield testing.

Now, the President argues "not to worry": should a problem in the stockpile be detected, he would invoke our "supreme national interests" rights under a CTBT in order to conduct whatever testing might be required. But this promise rings hollow in light of the President's earlier, unfulfilled promise that the U.S. would end its moratorium and resume testing if other nations tested. Since that Presidential promise over three years ago, both China and France have conducted numerous tests, and press reports suggest that Russia, too, may have conducted a test this past January.

Given these circumstances, it is all the more important to put in place the tools and skills and capabilities needed to sustain the nuclear stockpile. In announcing his decision to pursue a zero-yield CTBT, the President did embrace the so-called "Stockpile Stewardship Program". At the moment, however, that program remains a mere promise of a brighter future. And apparently the President's own staff doesn't share his enthusiasm for maintaining U.S. nuclear competence because the Office of Management and Budget continues to slash funds for Stockpile Stewardship, apparently unaware or indifferent to the serious national security implications of such efforts.

All of the above, plus serious concerns that have been raised about Energy Secretary O'Leary's travel habits and spending and seeming inattention to the core business of the Department -- namely, the nuclear weapons mission -- has led some of my colleagues to question whether the

Department of Energy is up to the task of assuring U.S. nuclear competence in the post-Cold War era, and whether the Department of Defense might be a better "home" for the nuclear mission. I suspect we may get into a discussion of that issue this morning as well.

To help us better understand these and other issues, we are delighted to have a distinguished panel of witnesses before the Subcommittee. They are:

Dr. Charles Curtis, Deputy Secretary of Energy
Dr. Victor Reis, Assistant Secretary of Energy for Defense Programs
Ms. Joan Rohlfing, Director of DOE's Office of Nonproliferation and National Security (and incidentally a former member of the staff of this Committee)
Dr. Harold Smith, Assistant to the Secretary of Defense for Nuclear, Chemical and Biological Weapons
Dr. Sigfried Hecker, Director, Los Alamos National Laboratory
Dr. Paul Robinson, President and Director, Sandia National Laboratory
Dr. Bruce Tarter, Director, Lawrence Livermore National Laboratory

Thanks to each of you for being here today, and to Ms. Rohlfing, welcome back! Before turning to the witnesses, however, I'd like to yield the distinguished and very able Ranking Member of the Subcommittee, Mr. Skelton from Missouri, for any opening remarks he'd like to make.

My plan would be to have Dr. Curtis offer an opening statement. Then I'd ask Dr. Reis, Ms. Rohlfing, and the Laboratory Directors to offer any brief, additional comments they might like to make. Finally, we'd turn to Dr. Smith a summary of his statement. And, without objection, all prepared remarks will be entered into the record in their entirety. Dr. Curtis, please proceed.

Mr. HUNTER. Having said that, the gentleman from California is recognized.

STATEMENT OF HON. RONALD V. DELLUMS, A REPRESENTATIVE FROM CALIFORNIA, RANKING MINORITY MEMBER, COMMITTEE ON NATIONAL SECURITY

Mr. DELLUMS. Thank you very much, Mr. Chairman.

First, I am still hoping that the ranking member of the subcommittee, Mr. Skelton, will be here, and I hope we keep a place marker for his opening remarks, and second, since I just traveled back from California, I really hope that he gets here.

At some later point in these proceedings where it is appropriate, perhaps we will make a number of observations. This is a significant hearing. I hope that there is a great exchange between and among us here.

I would only add one note. As I tried to listen very carefully to your opening remarks, while you and I are in different parties and we often have different politics, I would still urge that given the gravity and the significance of these issues, that we continue to stay on the high ground. I think that matters of personalities are inappropriate here. I think the issues are much more important and I would simply just lay that point down to you, sir, and I would yield back the balance of my time.

Mr. HUNTER. I thank the gentleman.

The chairman of the committee, Mr. Spence, thank you for being with us this morning.

STATEMENT OF HON. FLOYD D. SPENCE, A REPRESENTATIVE FROM SOUTH CAROLINA, CHAIRMAN, COMMITTEE ON NATIONAL SECURITY

The CHAIRMAN. Thank you. I am pleased to be here. I do not have any opening remarks. I just want to welcome all of our witnesses this morning. We have a lot of talent and expertise at this table and so we welcome all of you and look forward to hearing from you.

Mr. HUNTER. I thank the chairman. We have two other members of the committee. Would any other members like to make a remark here as we start out?

If not, we will ask Dr. Curtis to proceed. Dr. Curtis, thank you for being with us. The floor is yours.

STATEMENT OF CHARLES B. CURTIS, DEPUTY SECRETARY OF ENERGY, U.S. DEPARTMENT OF ENERGY, ACCOMPANIED BY GREG RUDY, ACTING DIRECTOR, OFFICE OF FISSILE MATERIALS DISPOSITION, AND TERRY LASH, DIRECTOR, OFFICE OF NUCLEAR ENERGY, U.S. DEPARTMENT OF ENERGY

Dr. CURTIS. Thank you, Mr. Chairman, and good morning to you and to the other members of the subcommittee and the distinguished members of the full committee. It is a pleasure to be here this morning to discuss the Department of Energy's budget request for fiscal year 1997 for the national security programs administered by the Department.

In your opening statement, you raised a number of serious issues. I believe that the Department has given them serious consideration and I look forward to the opportunity to have a full and fair exchange on these matters.

As we all recognize, this is an unusual year in that we are testifying in advance of the Department of Energy's budget detail being submitted to the Congress. Consequently, I will do the best that I can in responding to your questions about specific dollar expenditures, but I believe that many of these questions may have to be deferred until after next week when the budget is submitted or addressed in written response to your questions. I can assure you, however, that we will be prompt and attentive to your inquiries.

With me this morning is Dr. Victor Reis, the Department's Assistant Secretary for Defense Programs; Ms. Joan Rohlfing, the Director of our Office of Nonproliferation and National Security; and also accompanying me is Mr. Greg Rudy, the Acting Director of the Office of Fissile Materials Disposition, and Terry Lash, the Director of the Office of Nuclear Energy.

Dr. Reis and Ms. Rohlfing have prepared written statements. I ask that those statements and mine be included in the record at this point, Mr. Chairman.

Mr. HUNTER. Without objection.

Dr. CURTIS. Mr. Chairman, the Department is committed to maintaining an effective nuclear deterrent while working to reduce the worldwide nuclear danger. Our budget request for fiscal year 1997 supports the many challenges and opportunities that we face. The exhausting planning and study that has occurred since 1993 and the work with the Department of Defense has now placed the Department in a position to discharge this responsibility this year and through the remainder of this century and into the next. We look forward to a strong and continuing commitment to stockpile stewardship and management in the coming years.

The President, as you observed, has committed the United States to the achievement of a zero-yield Comprehensive Test Ban Treaty. Much of the work to support implementation and verification of such a treaty falls on the shoulders of the Department of Energy. The President's decision to seek a zero-yield Test Ban Treaty was based upon the judgment that the unique scientific and technical capabilities of the Department, its laboratories, and its industrial facilities will prove adequate to maintain our nuclear stockpiles safely and reliably in the absence of nuclear testing.

A strong nuclear deterrent continues to be a part of our national security strategy. The Department can meet the challenge to maintain the deterrent through a well-defined Stockpile Stewardship Program. But, as the President has also noted, in order for this program to succeed, both the administration and the Congress must provide sustained bipartisan support for the Stockpile Stewardship Program over the next decade and beyond. That is fiscal support. It is a question that you worry about and we worry about. It is a matter that we must join together on.

The nuclear weapons complex, both the laboratories and the production facilities, must be efficient and must have the right tools and equipment to meet the challenge. In February, the Secretary of Energy announced the Department's proposed plan that would enable the complex to meet the new challenges. The stockpile stewardship and management draft programmatic environmental impact statement does propose a smaller, more efficient defense complex comprised of three laboratories and four manufacturing facilities.

If this proposed plan is ultimately approved, and I observe that it is subject to hearings and a final decisional process that awaits conclusion in the remainder of this year, if it is ultimately approved, the complex will have, we believe, the physical capability to meet a wide variety of stockpile scenarios even in a constrained budget environment.

In December, the Department adopted a plan for safe and reliable supply of tritium and identified the Savannah River site for tritium processing and possibly tritium production. This plan will enable DOE to produce tritium by 2005 or 2007, if an accelerator is chosen.

The Secretaries of Energy and Defense recently signed a joint memorandum to the President recommending a course of action for management of the nuclear weapons stockpile. This plan, approved by the President on Monday, will establish a path forward for the Department to support both the lead and hedge aspects of the nuclear posture review.

As Secretary of Defense Perry said in hearings last week, the United States cannot move to START II on the basis of faith. Rather, that we have to be very pragmatic about it. The plans for the Department complex and for tritium supply are pragmatic and flexible and will support a START II stockpile or a START I stockpile, if necessary.

The question that DOE must be prepared to answer today and in the future is, can the Department in the absence of weapons testing continue to ensure the safety and reliability of the stockpile? Are our scientific and technical capabilities up to the task, and will they confidently be so in the future? We believe we can answer this quite proper demand in the affirmative, but to do so will require sustained funding of the work of the Department and careful, coordinated planning between the DOE and the Department of Defense.

In a process that began last summer, Department of Defense [DOD] and Department of Energy [DOE] have worked together to design a stewardship plan that will assure mutual confidence in the nuclear stockpile. This plan will be final in the very near future and will serve as the basis for the report required by section 3153 of the fiscal year 1996 Defense authorization bill.

We note that the report is due on the 15th of March. We hope to meet that date, or certainly within this month. We are working very hard to have that report available for your deliberations. We recognize that the committee, quite properly, needs assurance that this planning has proceeded and matured so that both we and you can have confidence that the mission is being effectively discharged.

Mr. Chairman, in the last few years, the Department has made, I believe, significant progress in putting a complex that was in disarray in 1992 back on track to support the Nation's National security programs. We have made progress, but much more remains to be done. This is a dynamic situation. We are still evolving the science-based stockpile stewardship and management plan and it is an interactive process that will be interactive through the remainder of this decade.

Now to turn to a related and important part of our national security responsibilities. Because of the unique capabilities of the Department of Energy and its laboratories, we are also an integral part of this Nation's nonproliferation efforts, one of the President's highest priorities. The threat proposed by the spread of weapons of mass destruction is ever changing. Today, some 20 countries have or may have the capability to develop weapons of mass destruction. Through research and development programs and intelligence contributions, DOE plays and will continue to play a key role in assessing and addressing these nuclear dangers.

A key component of the Department program is the lab-to-lab and government-to-government cooperative initiatives in which the Department of Energy has engaged their counterparts in the former Soviet Union and the New Independent States, with particular emphasis on the Russian Federation. DOE has worked cooperatively to establish and enhanced material export control systems and to improve the protection, control, and accountability of nuclear materials.

I observed that Margaret Thatcher in an address just this last week made the observation that in the post-cold-war environment, that the West has been perhaps somewhat complacent about the threat of nuclear weapons, once the threat of total annihilation appeared to dissipate. That threat is very serious. The nuclear material security programs of this Department and the collaborations in the former Soviet Union are very, very important to maintain security of the nuclear weapons materials in those states.

One of the key challenges arising from the end of the cold war is the need for safe, secure, and environmentally sound management of weapons-usable fissile materials both in the former Soviet Union and in the United States. Significant quantities of these materials, plutonium and highly enriched uranium, are now no longer needed for defense purposes and this budget proposes actions which begin the process of securing the storage, proper management, and disposition of these materials.

Mr. Chairman, I know the committee's time is limited and there are a large number of witnesses, so I will conclude my remarks and turn to Dr. Reis and Ms. Rohlfing for a few additional comments. I, of course, will welcome your questions on these most important matters. These are serious responsibilities and I hope that my testimony and the testimony of my colleagues will demonstrate to the subcommittee by thought, word, and deed that the Department is indeed taking these matters seriously. Thank you.

[The prepared statement of Dr. Curtis follows:]

STATEMENT OF CHARLES B. CURTIS
DEPUTY SECRETARY OF ENERGY

Before the Committee on National Security
Subcommittee on Military Procurement
United States House of Representatives

MARCH 12, 1996

INTRODUCTION

Good morning Mr. Chairman and members of the committee. Thank you for inviting me to appear before the committee to discuss the Department of Energy's national security programs. The Department has made significant progress in these essential programs over the past year and will continue to progress in the coming years. The ever changing United States security environment demands continuing flexibility on the part of the Department to meet a wide variety of contingencies. The cessation of underground nuclear weapons testing; the President's commitment to achieve a true zero yield Comprehensive Test Ban; U.S. ratification of the START II treaty and a determination by the Department of Defense to rely on existing weapons types to provide this nation's deterrent, are circumstances that have redefined the Department's national security responsibilities. At the same time, the Department continues to respond to the new and varied nonproliferation threats and arms control opportunities in the post Cold War environment. I welcome the opportunity to discuss both the challenges and the opportunities facing the Department of Energy.

The Department of Energy's budget request for fiscal year 1997 for atomic energy defense activities is $10,867,012,000 a $228 million increase above the fiscal year 1996 level. Of the amount requested for fiscal year 1997, $5,457,702,000 is for national security programs. This includes $3,710,002,000 for weapons activities,

$586,972,000 for Nonproliferation and National Security programs, $93,796.000 for fissile materials disposition, $67,000,000 for worker and community transition,$ 663,932,000 for Naval Reactors and $72,200,000 for Nuclear Energy.

This morning I am accompanied by the Assistant Secretary for Defense Programs, Dr Victor Reis, and the Director of the Office of Nonproliferation and National Security, Ms Joan Rohlfing. Both Dr. Reis and Ms. Rohlfing have prepared written statements setting forth in detail the programs for which each is responsible. As a result, this statement only highlights certain key aspects of those programs. Separate prepared statements for the other important national security programs funded in the DOE budget for atomic energy defense activities were not requested by the subcommittee and, thus, will not be submitted. I will discuss these programs in comparatively greater detail in this statement.

DEFENSE PROGRAMS

Congress, in the Atomic Energy Act of 1954, found that the development, utilization, and control of atomic energy for military purposes is vital to the common defense and security. This commitment to a strong nuclear deterrent continues today in the Department of Energy as a key part of the nation's security posture. In announcing his decision to support a zero yield test ban treaty, President Clinton reaffirmed his commitment to nuclear deterrence: "As part of our national security strategy, the United States will retain strategic nuclear forces......I consider the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States."

Last year, in testimony before this committee, I discussed the challenging responsibility facing the DOE to ensure the safety, security, and reliability of the enduring nuclear weapons stockpile in the absence of testing, and in the absence of any requirement to produce newly designed weapons. Since I last appeared before the subcommittee, the Department has, in conjunction with the Department of Defense, refined the Stockpile Stewardship and Management program, to meet these challenges. DOE has been working closely with the Department of Defense to shape and implement a stockpile stewardship and management program to meet fully the requirements of the Nuclear Posture Review.

The Secretary of Energy last month announced a specific set of proposals designed to reshape the DOE complex to fulfil the goals of the Stockpile Stewardship and Management Program and maintain deterrence as directed by the President. Our objective is to evolve a program that:

- Fully supports at all times, the U.S. nuclear deterrent with safe, secure, reliable, nuclear weapons while transforming the nuclear weapons complex (laboratories and production facilities) to one that is modern, efficient, and sized to maintain the enduring stockpile. A modern, efficient, environmentally sound complex will allow DOE to meet all contingencies identified by DOD, economically and expeditiously.

- Preserves the core intellectual and technical competencies of the weapons laboratories and the manufacturing facilities. Without nuclear testing, confidence in the U.S. nuclear deterrent will be especially dependent upon the competency of the people who must make the scientific and technical judgment related to safety and reliability of U.S. nuclear weapons and those who must make the weapons and weapons components when needed. The stockpile stewardship and management program will provide the tools, and enable the people responsible for maintaining the credibility of the nuclear arsenal, to have the fundamental understanding of the scientific phenomena associated with nuclear weapons. This knowledge and these tools will allow early detection and repair of any problems that may arise with the stockpile and ensure that new people brought into the complex are ready to assume responsibility in the future.

- Ensures the activities needed to maintain the nation's nuclear deterrent are coordinated and compatible with the nation's arms-control and nonproliferation objectives

TRITIUM

Tritium gas is a critical element in the operation of nuclear weapons and is, therefore, essential to the United States' ability to maintain its nuclear deterrent. Because tritium, a radioactive isotope of hydrogen, decays at the rate of about five percent per year it must be replenished on a periodic basis. Since 1988, the U.S. has had no capability to produce this essential gas. In October, the Department announced its dual track strategy for acquiring new tritium production capability. The two tracks are (1) purchase of an existing commercial light water reactor or irradiation services and (2) development of a linear accelerator. An additional part of the strategy is the development of a contingency plan to utilize existing light water reactors, if necessary in the nation's security interest. The Department will pursue both tracks and select a tritium production method in 1998.

DOE went through a comprehensive and open process to develop the dual track program. The strategy is designed to ensure that adequate tritium is available when needed, and that it will be provided safely and reliably. DOE is planning to have tritium production capability by 2007 if the accelerator is the technology chosen and by 2005 if the light water reactor is chosen. $50 million was appropriated for the tritium program in the fiscal year 1996. The Department has identified an additional requirement of $27 million that will be required to be made available for tritium in this fiscal year (1996) budget. DOE is requesting $100 million in fiscal year 1997 for the tritium program. Schedules for both the accelerator and light water reactor tritium production are attached

NONPROLIFERATION AND NATIONAL SECURITY

The President has made nonproliferation one of his highest national security priorities The threat of the spread of weapons of mass destruction and their delivery systems, the insecurity of weapons usable fissile materials, the acquisition of dual use technology and equipment, and the continuing development of covert indigenous capabilities by proliferant states, are serious dangers that threaten the United States and challenge international stability. The Department of Energy and its laboratories are uniquely situated to provide the expertise and leadership to address these threats.

To reduce the international proliferation threat, the Office of Nonproliferation and National Security will focus its resources and expertise on eight priority programs:

- securing nuclear materials, technology, and expertise in Russia and the Newly Independent States;
- maintaining effective protection, control, and accountability of nuclear materials, technology, and expertise in the United States;
- limiting weapons usable fissile materials worldwide;
- ensuring transparent and irreversible reductions of global nuclear stockpiles;
- supporting the completion of a Comprehensive Test Ban in 1996;
- developing and integrating a program for preventing. detecting, and responding to nuclear terrorism and smuggling;
- controlling nuclear exports; and
- strengthening the nuclear nonproliferation regime.

MATERIALS DISPOSITION

Long-Term Storage and Disposition of Weapons Usable Fissile Materials

One of the key challenges arising from the end of the Cold War is the need for safe, secure, and environmentally sound management of weapons-usable fissile materials both in the United States and the former Soviet Union. Significant quantities of these materials, including plutonium (PU) and highly enriched uranium (HEU), are now no longer needed for defense purposes. Further agreements on disarmament between the two nations may increase the surplus quantities of these materials. Global stockpiles of weapons usable fissile materials pose a danger to national and international security if they are not properly managed and disposed of in a manner that effectively precludes their reuse in nuclear weapons.

Within the Department of Energy, the Office of Fissile Materials Disposition is responsible for the Department's technical and management activities to provide for the safe, secure, environmentally sound future storage of all weapons-usable fissile materials and the disposition of the fissile materials declared surplus to national defense needs. The Department's Fissile Materials Disposition Program directs research and development and technical demonstrations of plutonium disposition technologies and the design phase for site-specific long-term storage configurations involving a coordinated approach to the Department's inventory of weapons-usable fissile materials.

Program efforts also include technical and industrial activities associated with conversion of surplus weapons-usable highly enriched uranium to non-weapons usable low enriched uranium suitable for use in commercial power reactors. Through the Fissile Materials Disposition Program, the Department and its National laboratories are providing the technical expertise to support a joint US-Russia study on technical options for the disposition of weapons-usable plutonium. The efforts of this program directly contribute to advancing U.S. and global nonproliferation interests involving Russia and other nations and to improving the cost-effectiveness of the Department's management of stockpiles of surplus fissile materials.

The goal of the Fissile Materials Disposition Program is to contribute to a reduction in the global nuclear danger associated with inventories of surplus weapons-usable fissile materials. The primary objectives of the program include:

- To provide a cost-effective, safe, secure, environmentally sound, inspectable, long-term storage configuration for the Department's weapons-usable fissile materials.
- To eliminate surplus stockpiles of highly enriched uranium and plutonium.

NUCLEAR SAFETY AND SECURITY

The Office of Nuclear Energy, Science, and Technology has responsibility, within the Department of Energy, for certain international programs related to nuclear safety, national security and nonproliferation. These programs are designed to:

- provide technical leadership for international nuclear safety and nonproliferation issues. including providing assistance to shut down the three Russian plutonium production reactors;
- assist in developing and maintaining nuclear safety centers of excellence both in the United States and in the states of the former Soviet Union; and
- assist the Ukrainians in the shutdown of the Chornobyl plant.

Technical Leadership

The Office provides policy and technical leadership for several critical initiatives concerned with nuclear technology, nuclear safety, and nonproliferation issues. A key element in the Administration's nonproliferation policy is the shutdown of Russia's three plutonium production reactors. In addition, the office of Nuclear Energy maximizes use of its existing programs to facilitate the transition of former Soviet nuclear and weapons scientists to non-defense activities, to engage in cooperative programs to address safety needs and non-proliferation issues at breeder reactors in the former Soviet Union, and to promote policies and develop spent fuel management plans to reduce the need for reprocessing nuclear fuel in countries of the former Soviet Union.

During the June 1994 session of the Gore-Chernomyrdin Commission, Russia agreed to shut down all of its plutonium production reactors by 2000. At the January 1996 Gore-Chernomyrdin Commission meeting, the Department presented preliminary results of technical assessments demonstrating the feasibility of converting the fuel for these reactors so that the reactors would no longer produce weapons-grade plutonium during routine operation. With this new core these reactors could continue to supply the heat and electricity that they now provide. In addition, the Department is supporting completion of a preliminary assessment to use fossil-generated replacement power. In fiscal year 1997 the second phase of the core conversion safety and design analyses, and testing of new fuel will be completed. Implementation will begin if the analyses and testing results are satisfactory. Successful implementation of core conversion would end weapons-grade plutonium production in the these reactors before 2000. Funding for conversion activities will be the responsibility of the Russian reactor operator. Conversion could be financed through loans backed by revenue from improved operating efficiencies brought about by the conversion. In addition, Nunn-Lugar funding may also be available.

International Safety Centers

An international nuclear safety center to promote continuing improvement of nuclear safety worldwide through collaborative research and development and open exchange of safety information has been established. Through the U.S. safety center, the Department funds and supports collaboration with nuclear safety research institutions worldwide as a means of improving nuclear safety infrastructures and cultures. Earlier this year DOE initiated collaborative nuclear safety-related research and development with a similar Russian center. By the end of fiscal year 1997 DOE anticipates expanding existing collaboration with the center in Ukraine and with organizations in Germany and Sweden.

International Reactor Safety

Within the international nuclear community, there is substantial concern over the continued operation of Soviet-designed reactors in Eastern Europe and the former Soviet Union that do not meet Western standards of safe design, manufacture or operation. DOE helps address the need to strengthen the safety culture within these countries, and to improve the physical condition and operation of these nuclear power. This program has resulted in over 150 projects, involving 17 plant sites, regulator authorities and over 8 design and scientific institutes, as well as 21 U.S. commercial companies.

The Department is providing technical leadership in the effort to shut down the Chornobyl nuclear power plant. This plant continues to operate two reactors and is one of the most volatile nuclear situations in the world. Unit 4 of the plant was severely damaged in 1986. In the meantime, DOE supports efforts to ensure the safe, short term, operation of the plant, to address the problems of decommissioning and waste management, including storage of spent fuel, and to upgrades fire protection and operational safety systems.

Funding for all of the programs in the Office of Nuclear Energy described above was provided through the Office of Nonproliferation and National Security in fiscal year 1996. In the fiscal year 1997 budget request, this funding would be provided directly to the Office of Nuclear Energy, Science and Technology.

NAVAL REACTORS

The mission of this activity continues unchanged -- engineering verification and improvement for over 130 operating naval reactors and development of a reactor for the Navy's new class of submarines. The Department of Energy is a partner with the Navy in the overall Naval Nuclear Propulsion Program; the Department's Office of Naval Reactors has responsibility for the reactor and the overall safety, reliability, and integration of the reactor plant.

The Naval Nuclear Propulsion Program has an impeccable operational, safety and environmental record -- over 4,600 reactor years of operation without any accident or release of radioactivity to the environment. This record validates the long standing joint Navy/Energy arrangement for this program. This level of operating compares to 2,100 reactor years of operation for U.S. commercial nuclear power plants and a world-wide total of about 5,000 reactor years. Naval Reactors' position in the Department provides the necessary independence to ensure safety oversight and control; the engineering basis for Naval reactors and reactor plants, which underpins the safety and reliability effort; and gives the assurance needed for the Navy to obtain agreement from foreign nations for nuclear powered warships to operate in their territorial waters and visit their ports -- all vital aspects of our defense posture.

Naval Reactors' longstanding record of success can lead to the mistaken impression that running the nation's largest reactor program has become a routine, institutionalized process. It has not. Continuing the Program's record requires constant technical vigilance. Consequently, the bulk of the fiscal year 1997 budget request goes toward strenuous testing, design confirmation, and improvements to the operating reactors This is a most important consideration as these plants must operate under difficult conditions -- high internal temperatures, presence of water as the coolant and means of transmitting energy, and radiation which is very corrosive to materials, coupled with constant transients in power needs to meet ship demands, the motion of a ship underway, and an operating life measured in decades now even for the reactor's core

The advanced fleet reactor core, the core for use in the SEAWOLF Class submarines, has been operating in the Trident test reactor at the Kesselring Site in New York State for two years this month. The reactor has accumulated almost 7,000 hours of operation, the equivalent of over seven years of fleet usage, and is performing flawlessly. Work on the next generation reactor for use in the new attack submarine is progressing on schedule.

As part of an aggressive downsizing effort, Naval Reactors has progressively reduced the number of test reactors from a peak of eight to two with the sixth plant shutdown only a week ago. An inactivation program is underway to realize the full savings from shutting down these plants and to put them in an environmentally benign condition.

WORKER AND COMMUNITY TRANSITION

The Office of Worker and Community Transition works with the local communities to ease the transition to a reduced DOE presence and encourage viable reuse activities. In addition, the Office is responsible for assistance to DOE and contractor employees who are laid-off as result of DOE downsizing and the evolving DOE program requirements pursuant to section 3161 of the Fiscal Year 1993 National Defense Authorization Act.

The fiscal year 1997 budget request for Worker and Community transition is the only source of funds for assisting communities impacted by reductions in DOE contractor employment. In many instances these communities are isolated and their economies are disproportionately affected by the level of Department of Energy Activity. DOE works closely with the community reuse organizations to define the reuse activities and target those opportunities that have the best potential to provide community assistance and establish long-term self sufficiency.

In the coming year the Department will continue with its restructuring activities. DOE plans to complete closure of the Pinellas Plant in Florida, involving the separation of an additional 500 workers. Further reductions are anticipated throughout fiscal year 1997 and DOE will provide the much needed assistance as required by law.

CONCLUSION

The United States will continue to face a broad array of nuclear dangers. The Department of Energy is committed to using all of its unique and valuable resources to address the many challenges that will arise in an uncertain future. Through a strong stockpile stewardship and management program the DOE will be a strong partner with the DOD in maintaining a smaller yet effective, safe, reliable, nuclear deterrent. Through an aggressive program of non-proliferation efforts, including cooperative work with Russia and others, research and development, and technical assistance, DOE can help reduce the spread of nuclear weapons and technology and secure and disposition weapons grade fissile materials The Department of Energy has strong programs in place to address the many aspects of the nuclear threat and will continue to be prepared to address any new or unforseen requirements. In meeting these challenges, some downsizing will inevitably occur. As the Department of Energy, the Department of Defense, and many other agencies of federal government have learned, reducing infrastructure and people is painful, but necessary. DOE will undertake any further reductions in the least disruptive fashion and will provide every assistance to affected employees and communities to ease the transition and facilitate reuse. DOE will meet all of its challenges and take advantage of its opportunities in a fiscally responsible way through well ordered and rational programs, carefully designed and assembled to meet urgent national security requirements and reduce the nuclear danger.

Mr. HUNTER. Thank you, Dr. Curtis. Before we move ahead with more testimony, I would like to recognize my friend from Missouri, the ranking member of the subcommittee, Mr. Skelton, for any remarks he might have.

STATEMENT OF HON. IKE SKELTON, A REPRESENTATIVE FROM MISSOURI, RANKING MINORITY MEMBER, MILITARY PROCUREMENT SUBCOMMITTEE

Mr. SKELTON. Thank you very much. I would first ask that my prepared statement be placed in the record, Mr. Chairman.

Mr. HUNTER. Without objection.

Mr. SKELTON. Thank you. I think it is very important that you hold this hearing today. It is part of our constitutionally mandated oversight role and I look forward to the testimony. It is with pleasure that I note that Joan Rohlfing is with us today, late of this staff, and I know her expertise so well. We thank you for being with us today.

Ms. ROHLFING. Thank you.

Mr. SKELTON. As you know, for some time, Mr. Chairman, I have been concerned about the retention of experienced personnel in our Department of Energy. Some of these management and oversight of nuclear materials require a special technical expertise, a talent that is just not learned overnight. As we listen to the testimony today and as we put together the authorization for this coming year, I hope we will pay close attention to the advise and counsel given this body today. This is a very uncertain and evil world in which we live. It is important that our Nation establish a steady future course of deterrents using both the conventional and nuclear facilities. Thank you.

[The prepared statement of Mr. Skelton follows:]

IKE SKELTON
4TH DISTRICT, MISSOURI

2227 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-2504
TELEPHONE (202) 225-2876

Congress of the United States
House of Representatives
Washington, DC 20515-2504

514-B N W SEVEN HIGHWAY
BLUE SPRINGS, MO 64014
(816) 228-4242

1616 INDUSTRIAL DRIVE
JEFFERSON CITY, MO 65109
(314) 636-3499

216 NORTH ADAMS STREET
LEBANON, MO 65536
(417) 532-7964

319 SOUTH LAMINE
FEDERAL BUILDING
SEDALIA, MO 65301
(816) 826-2675

OPENING STATEMENT
HOUSE NATIONAL SECURITY MILITARY PROCUREMENT SUBCOMMITTEE
MARCH 12, 1996

Mr. Chairman, thank you for holding the hearing today. As part of our constitutionally mandated oversight role, I look forward to the testimony and hope it leads to a better understanding of our nation's nuclear capabilities.

As my colleagues have heard me say, the time is now upon us to determine our national stature as a military power. With so much uncertainty and evil throughout the world, it is important for our nation to establish a steady, future course of deterrence -- using both conventional and nuclear power.

I note with pleasure the participation of today's witnesses. Each reports from a different position within our nuclear weapons infrastructure, and each presents a unique perspective on both our present and potential capability in the future. Your testimony should help us establish the strongest and healthiest nuclear program -- at the most affordable cost.

Mr. Chairman, as you know, for some time I have been concerned about the retention of experienced personnel in our DOE facilities. Management and oversight of nuclear material requires technical expertise, a talent not learned overnight. As we listen to the testimony today -- and as we put together an Authorization for the upcoming year -- I hope we will pay close attention to the advice and counsel of today's panel.

Attentiveness today may yield success tomorrow. Employment of our nuclear stockpile may be necessary in the future. Its reliability, therefore, warrants our review.

Thank you.

Mr. HUNTER. Thank you, Mr. Skelton.

We will now go to Dr. Vic Reis. Vic, the floor is yours.

STATEMENT OF DR. VICTOR REIS, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, U.S. DEPARTMENT OF ENERGY

Dr. REIS. Thank you, Mr. Chairman. Mr. Chairman, as you have noted, the Department has three broad responsibilities relating to defense program support of the nuclear stockpile: First, an assured tritium supply; second, the ability of the nuclear weapons complex as a whole to support the future stockpile within expected budgets; and finally, the ability to maintain the safety and reliability of the stockpile indefinitely without underground testing.

Our assured tritium strategy is based upon a dual track of commercial light water reactors and accelerator production and our approach to the production complex, as you have noted, of the complex of the future, is to downsize and modernize the current complex. Both these aspects of our program, I believe, are straightforward and easy to understand.

Much more difficult to understand is how can we maintain the stockpile without underground nuclear testing. One of the keys to making this happen is our ability to detect and assess defects which we know from experience will occur, so I would like to bring to this committee's attention one of a number of examples of how we are doing this already and what it means for the future. It is only by examining real cases that the credibility of the Stockpile Stewardship Program can be evaluated.

Several years ago, as part of our Surveillance Program, we noticed that an aging phenomena had caused a small defect in a particular weapon. Our original assessment was that the effect of this defect would range from negligible to large. The reason for this discrepancy is that the consequence of small defects, bumps and cracks, can be catastrophic in the rapidly changing, incredibly high temperature and density environment of a nuclear explosion and our computational codes have not been designed to handle small perturbations.

In the past, there is no doubt that this uncertainty would have been resolved with underground nuclear testing. Now, the approach was different. Both Los Alamos and Livermore independently began to work the problem. They each used different special computational codes to assess the effects of the defects and to validate these newer codes they designed and carried out physics experiments using lasers, pulse-powered devices, and shock tubes.

Further, a detailed review of the underground testing archive resulted that a similar defect had actually been observed and the results from the new validated codes was able to explain a previously anomalous result.

All said and done, the independent effect estimates from each lab were almost identical, and small, I hasten to add, so that after a detailed review with the Department of Defense, it was decided that remedial action was not required.

This example demonstrates the power of the science-space stewardship approach, two laboratories working independently, both using and developing the best scientific and computational codes and applying them to real problems on real weapons. The analysis was anchored in the extensive data base from previous underground tests and underlying the final judgments were a vigorous peer review and a continuous interaction with the Department of Defense. It also reveals that the key to successful stewardship rests not only with new tools but the expertise of the people who use them, the stockpile stewards.

At the bottom line, the Nation's confidence in the enduring stockpile is dependent upon the skills, judgment, and courage of the men and women of Los Alamos, Livermore, and Sandia Laboratories, the production complex, and the test site. Those qualities will be tested and challenged in the years to come and I believe the President's Stockpile Stewardship and Management Program will provide them with the means to meet the awesome responsibility of maintaining the nuclear deterrents without underground testing.

I urge your continued strong support for this program. Thank you very much.

[The prepared statement of Dr. Reis follows:]

Statement of Dr. Victor Reis
Assistant Secretary for Defense Programs
Department of Energy

before

House National Security Committee
Subcommittee on Military Procurement
March 12, 1996

Defense Programs is requesting $3.7 billion in FY 1997 to carry out our stockpile stewardship and management responsibilities. The need for a safe and reliable nuclear weapons stockpile remains unchanged. A credible nuclear deterrent remains the foundation of U.S. national security policy. President Clinton has stated on a number of occasions "the United States must and will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. In this regard, I consider the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States."

The United States' policy governing the nuclear weapons stockpile has undergone profound change to reflect the new and continually evolving geopolitical and military structures of the post Cold War world. In the past, our confidence in the stockpile was ensured through weapons research and development at the laboratories, supported by an extensive production complex and underground nuclear testing at the Nevada Test Site. In 1992, the United States announced a halt in the production and design of new nuclear weapons and a moratorium on underground nuclear testing.

In 1993, President Clinton continued the moratorium on testing and initiated the Science-Based Stockpile Stewardship program when he challenged the Department "to explore other means of maintaining our confidence in the safety, reliability, and performance of our weapons." The challenge was also supported by Congress through passage of the FY 1994 National Defense Authorization Act that directed the Secretary of Energy "to establish a stewardship program to ensure the preservation of the core intellectual and technical competencies of the United States in nuclear weapons." .

Last August, the President, emphasizing his continued support and confidence in science-based stockpile stewardship, announced that the United States would pursue a true zero yield Comprehensive Test Ban Treaty (CTBT) as a means of reducing the danger posed by nuclear weapons proliferation. The President also outlined a series of Safeguards, A through F, that define the terms under which the U.S. would enter the CTBT. Safeguard A specifically directs the conduct of a stockpile stewardship program to ensure the safety and reliability of the stockpile. In January, the Senate gave overwhelming approval to the START II Treaty and declared that the United States "is committed to proceeding with a robust stockpile stewardship program...."

The Stockpile Stewardship and Management Program, developed by Defense Programs in response to the above direction and policy guidance, is a highly integrated technical program for maintaining the safety and reliability of the U.S. nuclear stockpile. There are three primary goals of this program:

- Provide high confidence in the safety, security and reliability of the U.S. stockpile to ensure the effectiveness of the U.S. nuclear deterrent while simultaneously supporting U.S. arms control and nonproliferation policies.
- Provide an appropriately sized, affordable, environmentally sound, and effective production complex to provide component and weapon replacements when needed, including limited lifetime components and tritium, and
- Provide the ability to resume U.S. nuclear testing and reconstitute nuclear weapon production capacities, consistent with Presidential Directives and the START II Treaty, should national security so demand in the future.

Traditionally, the activities of the three weapons laboratories and the Nevada Test Site have been regarded somewhat separately from those of the weapon production plants. However, all stockpile stewardship and management activities must achieve a new, closer linkage to each other.

The Stewardship activities will play a major role in reducing the vulnerability of the smaller stockpile to single-point and common-mode failures, principally through research base support of the enhanced surveillance a new Stockpile Management initiative. The stewardship and management programs have shared responsibilities in advanced manufacturing and systems engineering studies to integrate technological drivers such as advanced computing into an efficient and effective production complex of the future. The Dual Revalidation program, managed by Stockpile Management, will encompass both laboratories and plants in a new joint process for validating the safety, reliability and performance of the stockpile over time. Finally, the Radiological/Nuclear Accident Response program, a Management function, continues to utilize capabilities throughout the weapons complex, including weapons expertise at the laboratories and specialized capabilities at the Nevada Test Site.

The Stockpile Stewardship and Management Program will transform the nuclear weapons complex from capacity-based to capability-based. The future complex will rely more on scientific understanding, computer simulations, computer aided design, and manufacturing agility rather than test empiricism and manufacturing capacity. Having a surge capability for reconstituting a larger stockpile in an emergency could permit the United States to further reduce its active stockpile if international conditions so warrant. Continued interactions with the commercial industrial base, through technology partnering, can leverage our limited resources with industry capabilities to assist us with advanced manufacturing methods, improved materials development, and high speed, integrated computing and communication systems.

II STOCKPILE STEWARDSHIP AND MANAGEMENT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

The national security policy changes over the last several years have not eliminated the need for any of the current or historical core competencies and capabilities at the weapons laboratories, industrial plants, or the Nevada Test Site. These competencies and capabilities must be maintained for the foreseeable future. Facilities in the current complex were sized to support a larger and more diverse weapons stockpile than will be required in the future and represent a capacity that exceeds our current need. On February 28, 1996, the Department released the Draft Stockpile Stewardship and Management Programmatic Environmental Impact Statement (PEIS) which will form the basis for the Department's transition to the capability-based complex of the future. The PEIS covers the future capabilities required of the three weapons laboratories (Los Alamos, Sandia and Lawrence Livermore) the four industrial plants (Kansas City, Pantex, Savannah River, and Oak Ridge Y-12) and the Nevada Test Site.

The Department's preferred alternative for stockpile stewardship proposes construction and operation of the National Ignition Facility and the Contained Firing Facility addition to the Flash X-Ray Facility at the Lawrence Livermore National Laboratory and the Atlas Facility at the Los Alamos National Laboratory. All three facilities examine different aspects of weapons physics, key to understanding weapon safety and reliability. It should be noted that the Dual Axis Radiographic Hydrodynamic Test (DARHT), planned for Los Alamos National Laboratory, is another key facility in support of the stockpile stewardship program, but is considered as part of the no action alternative because an Environmental Impact Statement has been prepared for that facility and an independently justified Record of Decision has been made.

The Department's preferred alternative for stockpile management proposes to downsize in-place the following activities: weapons assembly/disassembly at Pantex; nonuclear component fabrication at the Kansas City plant; and secondary and case component fabrication at Oak Ridge (Y-12). Pit component fabrication is to be reestablished with a small production capacity at Los Alamos. At this time, no preference has been established for high explosive component fabrication, but we will continue to examine this issue. For major stockpile management functions, downsizing at the current locations has a number of advantages. First, it minimizes the socioeconomic impact on the worker and communities surrounding the facilities. Second, it is the most cost effective solution. Finally, it lowers the technical risk and provides the needed flexibility to support potential variances in stockpile size under START I or START II.

While downsizing in place and the resulting decontamination and decommissioning activities will minimize the number of displaced workers, some job losses are inevitable. To assist the workers and host communities, the Department will prepare workforce restructuring plans, as required by law and in consultation with our stakeholders, to mitigate job losses. The Department will conduct public hearings in Washington, D.C., and at each of the affected sites in March and April 1996. The comment period runs from March 8, 1996, to May 8, 1996. A final Environmental Impact Statement is scheduled for July followed by a Record of Decision in August 1996.

III STOCKPILE MANAGEMENT ACTIVITIES

The Stockpile Management program continues its historical responsibilities to provide near term and long range support for the stockpile, and for ensuring an adequate supply of tritium. It also includes new programs and procedures to deal with the aging stockpile, a result of no requirement to build new weapons. Along with stockpile surveillance, the historical responsibilities include normal maintenance, corrective maintenance and system refurbishment, as well as weapon dismantlement. The DOE has completed a separate Programmatic Environmental Impact Statement for tritium production, and is pursuing a dual-track approach to select a production method by 1998.

The current stockpile is safe, secure, and reliable. However, the history of the stockpile has shown that continuous surveillance, repair, and replacement of components and subsystems are commonplace. In fact, the nine weapons that will be in the START II stockpile have already been retrofitted to varying degrees and some have had major components of the nuclear system replaced. We cannot predict with any certainty when such problems will arise in the future, but we expect that as the stockpile ages beyond its intended lifetime, these types of problems may become more commonplace.

An enhanced surveillance program has been initiated to better predict weapon components failure, due to aging, in order to allow refurbishment of the stockpile. We are looking at new methods for manufacture that will provide more efficient realization of products with waste-stream minimization. Our maintenance program not only deals with ongoing weapon upgrades and modifications, but also with the routine need to exchange limited-life components like tritium reservoirs and neutron generators.

Several new programs have started focusing on weapon evaluation, such as dual revalidation of the W76 warhead in the Trident and the new requirement of the President for annual certification of the stockpile. Finally, our emergency response program is ready in the event of a nuclear incident or accident. This program conducts several exercises annually, at various levels, to maintain its response capability.

Surveillance

Ongoing surveillance is vital to the continuing viability of the stockpile. These activities support the entire weapons stockpile in the quantities authorized by the Nuclear Weapons Stockpile Plan. Surveillance is conducted by inspecting a statistically significant number of each weapon type drawn from the stockpile annually, tearing them down, testing the components, and, in most cases, rebuilding them and placing them back into the stockpile. A few of these weapons are tested to destruction. A selected number of flight tests with simulated nuclear components are also performed annually. This process requires that the tested weapons that are rebuilt are reassembled from components that were originally manufactured or stockpiled when the weapon was being produced. In some cases, we expect to run out of new components and will have to substitute replacement components or otherwise determine how to rebuild them.

The surveillance program historically has been successful in discovering weapons defects. We expect that it will continue to find between one and two defect types per year, which will require some degree of augmented maintenance. We are currently testing pits (Los Alamos), secondaries (Y-12), neutron generators (Sandia), detonators (nuclear design laboratories), gas reservoirs (Savannah River), and nonnuclear components (Kansas City), in addition to the main line disassembly activity ongoing at Pantex.

Maintaining the Stockpile

Maintaining the stockpile has become a program which will provide for indefinite life extension. Before the end of the Cold War, the average life of all weapons in the stockpile never exceeded 13 years, also the current average, and weapons rarely remained in the stockpile beyond 30 years. With no new weapons planned, weapons will soon begin to approach an age beyond our experience base. DOE must continue to supply hardware for Limited Life Component Exchanges (LLCEs), provide hardware to support ongoing and approved future refurbishment through the Stockpile Life Extension Program (SLEP), and provide hardware to prevent attrition of the stockpile by the surveillance program. In addition, we must continue to meet the stockpile requirements for Field Service, logistics support functions, and dismantlement and storage.

With weapons being retained in the stockpile for an indefinite period, individual weapon parts could eventually reach the limit of their reliable lifetime and may require refurbishment or replacement. Thus, design, production, and refurbishment capabilities must be structured to respond to the requirements of the SLEP. Near-term scheduled deliverables supporting the stockpile include: LLCE (tritium reservoir and replacement activities), stockpile refurbishment (B61 Alterations, B83 quality improvement program, W76 neutron generators, W87 life extension program), surveillance rebuilds (W88 pit), and the capability to design and develop changes to existing warheads and components (warhead protection program, common radar for B61/B83 and new tritium reservoir for W76).

Dual Revalidation

Dual Revalidation is a new, robust form of peer review designed to assure both DOE and DoD that the stockpile remains safe, secure and reliable. The Dual Revalidation Program was approved by the Nuclear Weapons Council (NWC) in January 1996. In the absence of underground nuclear testing and with no new warhead development, this new process will validate, with high confidence, that the stockpile will continue to meet its specifications for Military Characteristics (MCs) and Stockpile-to-Target Sequence (STS).

Under Dual Revalidation, two teams will perform independent evaluations, the first team drawn from the original design laboratory and the second team from the alternate laboratory. Dual Revalidation will provide a baseline assessment of the condition of the warhead today and a process to identify future problems. The evaluation will be managed by the joint DoD/DOE Project Officers Group and is expected to take 2-3 years for each warhead type. The W76 will be the first warhead revalidated. The increased DoD involvement in and technical understanding of the assessment should provide them with the confidence in the stockpile previously supplied by nuclear testing.

New Annual Certification Procedure

A primary DOE responsibility is to certify the safety and reliability of the nation's nuclear stockpile. As a result of the President's August 11, 1995, announcement, there is a new annual reporting and certification requirement, requiring the Secretaries of DoD and DOE, as advised by NWC, the Commander of the U.S. Strategic Command, and the Directors of DOE's Nuclear Weapons Laboratories, to provide an annual certification that the stockpile is safe and reliable in the absence of nuclear testing. A broad-based review of ongoing efforts and existing documentation will be conducted each year; it is not intended as justification for any new program(s). All active and inactive weapon types will be considered by the weapons laboratory responsible for the original design and the DoD-led joint Project Officers Group. This effort is intended to assure the President that nuclear weapons are safe and reliable as we continue on the path to a true zero yield CTBT. We expect to submit the first annual report to the Secretaries of Energy and Defense in August 1996.

Enhanced Surveillance Program

Enhanced surveillance is an essential development program for stockpile management. The program was finalized in the first quarter of FY 1996 and the development effort was initiated in the second quarter. It is the critical element of the SLEP and uses advanced science to predict component and material lifetimes. The enhanced surveillance program is a complex-wide integrated program involving the four production plants and the three weapons laboratories and is central to restructuring our stockpile maintenance and refurbishment procedures in an era without underground nuclear testing and no new production.

To accomplish this effort, enhanced surveillance will focus on three major areas: 1) materials science, 2) development of materials aging models, and 3) testing and monitoring technologies. This program will develop models which will account for aging effects in weapons materials, components, and systems that will help us to predict service lifetimes and to schedule ,with the DoD, necessary component replacement. Because the stockpile of the future will be smaller and less diverse, we must proactively identify and repair components before they fail (due to aging effects) to ensure the maintenance of a credible stockpile. This will have the effect of making all weapons components subject to time-phased replacement with lifetimes varying widely, for example, metal versus plastics. The advanced diagnostic and testing techniques developed in this program will collect information that not only supports our model development, but advances our knowledge of the behavior of these complicated materials and components over time. It is anticipated that diagnostic instruments may be required that can be placed in a weapons system to monitor critical components in real time.

The surveillance techniques, procedures, and models developed in this program will be incorporated into the ongoing core surveillance program when we are confident of their validity. With these new tools, our program of stockpile maintenance will be in a genuinely predictive mode.

Advanced Manufacturing Capabilities

Advanced Design and Production Technologies (ADaPT) is an initiative to coordinate and focus the activities of the laboratories and weapons plants in the creation of a reconfigured and rightsized production capability. It will be a necessary element to tie surveillance activities to future manufacturing capabilities. ADaPT will exploit emerging information and manufacturing technologies to better integrate the nuclear weapons complex and will develop modular, scalable, environmentally sound manufacturing processes needed for maintenance of a reliable stockpile under a wide range of demands. Current ADaPT work is concentrated on planning and evaluation of current advanced manufacturing activities in the plants and laboratories.

Transportation of Special Nuclear Materials

The transportation of special nuclear materials has become an increasingly important element of stockpile management as a result of both dismantlement and the restructuring and consolidation of military bases in the United States. The Department provides for the transportation of special nuclear materials, nuclear weapons, and weapons components throughout the continental United States via specially designed safe, secure tractors and trailers (SST's).

The Department has accumulated more than 83 million miles of over-the-road experience with no accidents causing a fatality or release of radioactive materials, and without damage or compromise of the cargo. Much of this can be attributed to the well managed, highly trained, competent, and dedicated work force of more than 260 couriers with nationwide secure communications. In addition, largely due to our specialized in-house training capability, the nuclear material couriers are one of the most highly effective protective forces in the world. Seventeen new trailers called Safe Guard Transporters (SGT), incorporating the latest advances in materials and transportation technology, are currently being built to keep the overall system best in class.

Dismantlement

Since the end of World War II, the Department and its predecessors have disassembled some 55,000 nuclear warheads in a safe, secure, and an efficient manner. During the last fiscal year, 1,393 weapons were safely dismantled at the Pantex Plant. Since the beginning of the current fiscal year we have dismantled 545 warheads, and expect to complete the FY 1996 total goal of 1,164. We are on schedule to complete the W48, B61 mod 0, and W70 dismantlement lines and start up the B61 mod 2 and W69 dismantlement lines.

In FY 1997, we expect to dismantle about 1,300 nuclear weapons and will complete the W55 and B61 mod 2 dismantlement lines and start the W56, B61 mod 5, and W79 lines. The planned dismantlements should eliminate the backlog of retired weapons by FY 1999 and supports DoD activities. The Pantex workload is expected to remain stable for the next several years as we reduce the nuclear stockpile consistent with our arms control commitments.

Emergency Response

The Emergency Response program is the U.S. Government's singular national capability to provide the critical technical expertise necessary to resolve any major radiological emergency or nuclear accident within the United States and abroad. Its intimate association with the nuclear weapon complex allows us to capitalize on weapon program core activities in both the areas of stockpile stewardship and management. The all-volunteer force that make up the cadre of deployment forces are mostly from the core weapons program.

Not withstanding the Department's pursuit of both the dismantlement program and our commitment to ensuring a safe, secure, and reliable stockpile, we must have the necessary plans in place to provide a rapid response in the event of a nuclear weapon accident. While the occurrence is extremely unlikely, we are prepared to effectively mitigate the consequences of an accident. We are in the initial planning stages for a full field training exercise, where DOE will be in charge of command and control as well as provide the technical expertise necessary to resolve the accident. This exercise is scheduled for mid-1997.

Further, as result of the breakup of the Soviet Union and our aggressive stance to curb the development of weapons of mass destruction, the Department plays a vitally important support role in combating acts of nuclear terrorism, through its Nuclear Emergency Search Team (NEST). NEST provides the operational and technical expertise to the Federal Bureau of Investigation in the United States, and supports the State Department in a similar manner overseas. We have vigorously pursued bringing the program up to present day standards necessary, based on the available intelligence, to counter the current nuclear threat and trends in these activities. Our present and near-term activities include continuance of a rigorous training program and pursuing improved search, device assessment and disablement capabilities.

Tritium Supply

An integral part of ensuring confidence in the stockpile is providing an adequate supply of tritium, a radioactive gas required for all U.S. nuclear weapons to operate as designed. Tritium, with a half life of 12.3 years, decays at a rate of 5.5 percent per annum. To meet current stockpile requirements, the Department is recycling tritium from dismantled weapons. A new tritium production source will be needed by the year 2005 to maintain the START I stockpile, and the associated 5-year tritium reserve, until full ratification and entry into force of the START II Agreement. The current supply of tritium is sufficient to meet the START II stockpile, and the associated 5 year tritium reserve, until 2011, as given in last year's testimony.

Last year, the Department completed work on the Tritium Supply and Recycling Programmatic Environmental Impact Statement. On December 6, 1995, the Secretary issued the Record of Decision in which the Department outlined a dual track strategy for assuring a safe, reliable source of tritium to meet national security requirements. One track will investigate the purchase of a commercial reactor or irradiation services. The other track will develop and test accelerator production of tritium. The Department has requested $100 million in the FY 1997 budget to pursue both alternatives. By 1998, one of these alternatives will be selected to become the primary tritium production method. The other, if determined to be feasible and practical, could become an assured backup capability.

There are no difficult technical issues associated with the production of tritium in a light water reactor but there are regulatory and licensing uncertainties. Tritium producing targets for use in light water reactors were developed and tested several years ago but work on the target development program was suspended by Congress in 1992. During the past several months, the Department has revived this effort. While additional target qualification studies are needed to support regulatory and owner approval for their use in commercial reactors, the work already accomplished has demonstrated that the target will work extremely well in light water reactors.

Recently, the Department invited expressions of interest from electric utility companies owning commercial nuclear facilities to determine their preliminary level of interest in either selling a reactor or irradiation services to the Department for tritium production. The response to that invitation has been very encouraging, and we will soon be developing a formal solicitation of proposals for the sale of facilities or services to the Department to make tritium. In addition, within the next few weeks, the Department and the Nuclear Regulatory Commission (NRC) will conclude the development of a Memorandum of Understanding governing the interaction between the two agencies for target qualification and NRC reactor licensing activities.

Technical activities in FY 1997 for the commercial reactor approach will include target testing to support qualification, target fabrication demonstrations to support target procurement, and extraction process development to support construction and upgrade of the Savannah River tritium facilities. Initial confirmatory target testing in commercial reactors is planned for late FY 1997 as is the conditional selection of a reactor or reactors which the Department would use to meet tritium requirements.

The accelerator alternative has comparatively minor nonproliferation and regulatory concerns and requires no technological breakthroughs. However, several features and portions of the technology need to be demonstrated at production power levels. The design choices (e.g. proton energy, power requirements, size of the plant, and accelerator components) will only affect the cost, reliability, and maintainability of the system. The project includes a development effort to select between technical alternatives, testing to establish performance and reliability, and the use of industry for conceptual and engineering design and, if built, construction. These efforts will narrow the cost uncertainty range. The Savannah River Site will be the location of the accelerator if a decision is made to proceed with construction.

Accelerator production of tritium activities in FY 1997 will focus on developmental engineering and component qualification to establish baseline design of the accelerator components. Most of these activities will be done by or under the technical direction of

Los Alamos National Laboratory. During this year, the prime contractor for the APT production facility will complete a Conceptual Design Report (CDR), which will establish baseline design and greatly narrow the cost uncertainty. This report would also provide a basis for requesting approval to begin engineering design in FY 1998.

IV STOCKPILE STEWARDSHIP

In the past, nuclear testing filled the gaps in the basic understanding of complex physics phenomena and provided high confidence in the certification of nuclear safety and performance. Existing tools which were used in conjunction with nuclear testing are inadequate if used alone. Assessment of stockpile problems and certification of repairs or replacements of nuclear components in the future will have to rely on improvements to these tools. Science-based stockpile stewardship will focus on obtaining more accurate and complete scientific understanding and experimental data, developing advanced computer simulations, and validating new tools using past nuclear data and new experimental data.

The key to the success of the Stockpile Stewardship and Management Program are the three weapons laboratories and their core intellectual and technical competencies. On September 25, 1995, President Clinton concluded that the "vitality of all three DOE nuclear weapons laboratories [is] essential and directed DOE to maintain nuclear weapons responsibilities and capabilities adequate to support science-based stockpile stewardship." The competencies of the weapons laboratories embody more than 50 years of knowledge and experience that cannot be found anywhere else in the United States. The science and engineering technology base at the laboratories is responsible for meeting all technical requirements for U.S. nuclear weapons. The personnel at these laboratories currently perform the basic research, design, system engineering, development testing, reliability assessment, and certification of nuclear performance using existing experimental facilities and computational capabilities. In addition, they determine and control all technical specifications that are used by the industrial base for manufacturing and surveillance operations and for maintenance operations conducted by DoD. Data from these operations is provided to the weapon laboratories for assessment and technical resolution of performance and safety problems.

Because there is no absolute guarantee that the initiatives discussed below will provide the capabilities to ensure the safety and security of the stockpile without underground nuclear testing, the United States will maintain the capability to conduct nuclear testing at the Nevada Test Site (NTS). The Department will also maintain the necessary technical capabilities at the weapons laboratories to design and conduct such tests.

Advanced Experimental Capabilities

The National Ignition Facility (NIF) is being designed to produce, for the first time in a laboratory setting, conditions of temperature and density of matter close to those that occur in the detonation of nuclear weapons. The NIF's 192 beam laser with 50 times more energy than any existing laser is intended to be capable of compressing a tiny capsule of hydrogen isotopes to pressures 100 billion times earth's atmosphere and at temperatures hotter than the center of the sun. Nuclear fusion, that occurs in stars and weapons, is predicted to occur in the tiny NIF target. The ability to study the behavior of matter and the transfer of energy and radiation under these conditions is key to understanding the basic physics of nuclear weapons and predicting their performance without underground nuclear testing. Experiments at the NIF could test the validity of computer-based predictions and demonstrate how aged or changed materials in weapons could behave under these unique conditions. The challenges and research opportunities at the NIF would attract world-class scientists and engineers, thus help ensure that the Nation's national security challenges could be addressed by laboratory experts second to none.

Recently, the inertial confinement fusion program and its technical basis for the NIF were favorably reviewed by the Inertial Confinement Fusion Advisory Committee, and the relationship between stockpile stewardship and the NIF was specifically and positively endorsed by the JASONs. During the past year, the Office of Arms Control and Nonproliferation of DOE completed public hearings and a thorough study on the "Issue of the NIF and Nonproliferation". In December 1995 Secretary O'Leary determined that the construction of the NIF supports the nuclear nonproliferation objectives of the United States.

Construction of the NIF is part of the stockpile stewardship preferred alternative in the recently released Draft PEIS for Stockpile Stewardship and Management. The environmental analysis concerning NIF in the final PEIS will be sufficient for approving its construction and operation. The final decision on location of the NIF will not occur until the Record of Decision later this summer.

Title I design activity is now underway and will provide cost estimates on the project baseline in the fall of 1996. The FY 1997 budget request of $191 million will provide funds to prepare an industrial component fabrication capability and to complete Title II, site-specific, detailed construction design. This work will provide the basis for a construction decision by the Administration in mid-1997.

Current hydrodynamic testing facilities, the Pulsed High Explosive Radiographic Machine Emitting X-rays (PHERMEX) at the Los Alamos National Laboratory (LANL) and the Flash X-Ray facility (FXR) at Lawrence Livermore National Laboratory (LLNL), were adequate to meet the challenges of stockpile stewardship in conjunction with nuclear testing. In the absence of nuclear testing, however, more capable hydrodynamic testing facilities will be required. The Dual Axis Radiographic Hydrodynamic Test facility (DARHT) planned for construction at LANL is the first such facility. Through its dual-axis, multi-time viewing capability, it will provide crucial experimental data on many of the systems in the stockpile and hence will directly support performance and safety revalidation, enhanced surveillance, and an improved predictive capability. Furthermore as the most capable hydrodynamic testing facility in the complex, DARHT will play a central role in developing advanced technologies for a next-generation Advanced Hydro test Facility.

Construction of DARHT was enjoined by a Federal Court order in January 1995, pending completion and judicial review of an Environmental Impact Statement (EIS) and associated Record of Decision (ROD). The EIS was completed in August 1995 and the ROD issued in October 1995. A motion to dissolve the injunction was filed subsequently by the Department of Justice, but the issue remains before the court at this time. The ROD states the Department's intention to finish the facility using new and improved technology as appropriate, and also directs implementation of a phased containment process to reduce by 75% the environmental emissions from radiographic hydro testing. The Department, in conjunction with the Department of Justice, has supported this project through the thorough and accelerated completion of the EIS, release of an unclassified environmental impact summary developed from certain classified matter, and an expedited response to the Federal Court's clearance request for three of its staff.

The Atlas facility to be located at Los Alamos National Laboratory is also included in the list of new experimental capabilities. The facility provides a pulse power experimental capability to address secondary weapons physics in an energy rich, high energy density environment. The FY 1997 budget includes $15M to allow construction to begin in mid FY 1997.

The Los Alamos Neutron Science Center (LANSCE), while not a new facility, is the most powerful neutron research facility in the world, providing an intense source of pulsed neutrons for experiments supporting national security and civilian research. Neutrons are unique and valuable probes of matter on scales ranging from the subatomic to complex materials. At low energies, neutrons are used to study many critical weapons materials issues. At higher energies, neutrons probe the small-scale structure of atomic nuclei, which is important for studies of nuclear weapons processes. At the very highest energies, neutrons can penetrate very thick materials providing unique surveillance capabilities.

LANSCE now has in place a substantial program focused on its key mission in stockpile stewardship. The program is divided into five projects : Advanced Radiography, Weapons Materials, Weapons Nuclear Physics, High-Explosives

Characterization, and Weapons Design Physics.

Advanced Computer Capabilities

The Accelerated Strategic Computing Initiative (ASCI) is a major part of Defense Program's response to Presidential decisions to halt nuclear weapons tests and pursue a zero-yield Comprehensive Test Ban Treaty. ASCI is designed as a balanced program to accelerate the development of nuclear weapons simulation codes, scientific understanding of weapon behavior, advanced computer platforms, and computing environments and infrastructure. These advances are essential for addressing the challenges of creating the only credible integrated test bed alternative to nuclear testing by using simulations for investigating performance, safety, and reliability of weapons in the nuclear stockpile.

ASCI will build on the core stockpile computing program at the weapons laboratories to develop the applications, computers, and simulation capability for integrated device assessments, and a predictive aging capability to enable a focus on extending the lifetime of the current stockpile. ASCI will work closely with the U.S. computer industry to accelerate companies' technology plans to provide computer systems that far exceed current industry predictions, but ones which are absolutely essential for stockpile stewardship success. ASCI will also engage U.S. universities to work on problems that are critical to physics, materials modeling, and computer science issues that are needed to support the ASCI simulation capabilities.

The simulation of nuclear weapons requires a weapon applications capability improvement of 10,000 to 100,000 times more than the current design capability. ASCI will create multiple industrial research partnerships to accelerate current performance trends in supercomputers. It is not possible to predict which technology path will lead to the best results; indeed, it is unlikely that a single technical approach will serve all application needs. Therefore, the research partnerships must overlap both in time and in technical approach in order to achieve a high payoff with manageable risk, ensure flexibility, and provide a diversity of technical approaches. To accelerate development of computer hardware, software, and communications, an aggressive, integrated, and sustained approach is required which accelerates important computer technology including: advancing the availability of very high performance computers--systems capable of 100's of Teraops (trillions of scientific operations per second), high speed interconnect and encrypted links, and distributed high performance computing (HPC) environments.

ASCI is well underway. In FY 1996, ASCI funded 11 new code or constituent model start-up efforts. Four of these code starts focus directly on increasing the ability of laboratories to predict the integrated performance and safety of weapons through computational means. On August 22, 1995, the Secretary announced the Defense Programs procurement of the world's fastest computer to be delivered to Sandia

National Laboratory in December 1996. This computer will run at more than one trillion operations per second and will be dedicated to solving difficult weapons problems. On February 20, 1996, the Department, through Los Alamos and Lawrence Livermore National Laboratories, announced a competition for a follow-on system that will explore a different architecture and will run at three trillion operations per second. In order to support collaboration among ASCI researchers at the three laboratories, the first secure high-speed data network linking the Los Alamos, Sandia and Lawrence Livermore National Laboratories was established on October 20, 1995.

The ASCI program will continue to advance during FY 1997. Significant efforts will be required to continue the development of the codes started in FY 1996. The development plans for these codes include the delivery of initial capabilities needed to certify planned near-term stockpile modifications (e.g. W76 re-certification, W88 pit rebuild, and B61 Mod 11.) The development of these codes also requires a significant interface with Defense Programs experimental facilities for verification and validation. FY 1997 will also see the delivery of the one trillion operations per second computer at Sandia and two development systems for the three trillion operations per second computer at Los Alamos and Lawrence Livermore. Significant modeling, software, and infrastructure work will be required to enable weapons code development and simulation on those computers. The FY 1997 budget requests $122 million for ASCI.

The ASCI can and should proceed rapidly. It will provide continual improvement to our assessment and certification tools in the core stockpile computing and modeling program. For example, recently developed 3-D computer models that can now begin to interpret the complex fluid instabilities near special weapon features, provided essential data on design changes to the W-87 warhead. This data was a significant factor in allowing us to proceed without testing.

Test Readiness

President Clinton has directed the Department to maintain a basic capability to resume nuclear testing activities at the Nevada Test Site (Safeguard C) should the United States deem it necessary. One of the ways the Department will retain this capability is to conduct, over the next several years, a series of subcritical experiments with nuclear materials at the Nevada Test Site. Two subcritical experiments are planned for FY 1996 and four for FY 1997.

Subcritical experiments use high explosives to create some of the physical conditions, such as pressure and temperature, under which nuclear materials function in a nuclear weapon. These experiments will provide an improved understanding of certain dynamic material properties of plutonium essential for assessing nuclear warhead performance, reliability, and safety. Subcritical experiments will help the U.S. monitor the aging nuclear weapons stockpile, and assist in developing our computational and modeling capabilities by providing essential experimental data on the performance of aging warhead components.

Above ground experimental programs, conducted at the weapons laboratories as a part of the Stockpile Stewardship and Management Program, also contribute to readiness in a variety of ways. This includes experiment planning and pretest preparations, the conduct of the experiments, and reduction and interpretation of post-shot data. Of special importance to test readiness is the area of diagnostics and data acquisition, including the continued development of sensors, recording instrumentation, and data interpretation techniques

The Nevada Test Site is planning training exercises to practice the skills and functions necessary for nuclear testing which are not involved in either the subcritical experiments or the high explosives experiments which take place at the site. To further preserve a nuclear testing capability at the test site, the processes necessary for conducting nuclear tests are being carefully archived. A core roster of experienced retirees, which could be called up if testing were to be resumed, is also being compiled. The FY 1997 budget has requested $164 million to support Nevada Test Site readiness.

V FISCAL YEAR 1997 BUDGET SUMMARY

The following table breaks out the FY 1997 budget requirements for Defense Programs in the Weapons Activities appropriations account. The request of $3.7 billion, reflecting our total obligational authority requirements, is allocated among three major program areas: Stockpile Management ($1.8 billion); Stockpile Stewardship ($1.6 billion); and Program Direction ($0.3 billion). This latter account provides the Federal salaries and related administrative expenses to manage the Stockpile Stewardship and Management Program.

DEFENSE PROGRAMS
FY 1997 CONGRESSIONAL BUDGET
($'s IN MILLIONS)

	Adjusted FY 1995	Adjusted FY 1996	Proposed FY 1997
Stockpile Management			
Base Stockpile Management	1,438	1,599	1,496
Tritium Supply	0	75	100
Enhanced Surveillance Program	0	18	40
Radiological/Nucl. Accident Response	69	71	80
Special Nuclear Materials - Surveillance	80	81	83
Subtotal: Stockpile Management	1,587	1,844	1,799
Stockpile Stewardship			
Base Stockpile Stewardship	968	1,008	1,041
Nevada Test Site Readiness	200	183	164
National Ignition Facility	6	61	191
Accel. Strategic Computing Initiative	0	85	122
Education	20	10	10
Technology Transfer	214	149	49
Subtotal: Stockpile Stewardship	1,408	1,496	1,577
Weapons Program Direction	365	327	334
TOTAL DIRECTED PROGRAM	3,360	3,667	3,710
Use of Prior Year Balances	-148	-211	0
NEW OBLIGATIONAL AUTHORITY	3,212	3,456	3,710

VI CONCLUSION

The purpose of the Stockpile Stewardship and Management Program is to ensure the safety and reliability of the nuclear weapons stockpile, without underground testing. Our strategy is based upon a stockpile life extension program that treats each component of each weapons as a limited life component; a dual track approach to ensure a supply of tritium; assessment and certification procedures based upon previous tests; a more detailed scientific understanding of weapon processes and advanced computation; and a downsized, but modernized and flexible production complex. We believe this strategy best fits the nuclear requirements for the post Cold War era, balancing support for the current stockpile with the research needs for extending stockpile life and maintaining the vitality of the research, production, and testing team.

Mr. HUNTER. Thank you, Dr. Reis.

Ms. Rohlfing.

STATEMENT OF JOAN B. ROHLFING, DIRECTOR, OFFICE OF NONPROLIFERATION AND NATIONAL SECURITY, U.S. DEPARTMENT OF ENERGY

Ms. ROHLFING. Good morning, Mr. Chairman and members of the committee. As a staff alumnus of this committee, it is a special pleasure to come before you today. As many of you know, it was not long ago that I sat in the seat that Chris Williams is occupying today. Somehow, I think, Chris, you got the better end of the deal. It is always more fun to help pose the hard questions than to have to answer them.

Of course, that is not to say that I am not enjoying my new responsibilities as Director of DOE's Office of Nonproliferation and National Security. In fact, it has been a distinct honor to serve in this new capacity and to help shape and direct the very important work of the Department's efforts in nonproliferation and national security.

Because time is short and you have a very full agenda this morning, I will confine my oral remarks to a brief description of only two of the Department's remarkable accomplishments in the area of nonproliferation over the last year.

Let me start by describing the great progress we have made in helping Russia and other former Soviet states secure their nuclear materials. Mr. Curtis in his statement has already emphasized the importance of our Materials Protection Control and Accounting Program. I would like to offer you just a few metrics to describe our progress.

Last year, my predecessor, Mr. Ken Baker, came before the committee and recounted our success in initiating this Materials Protection Control and Accounting Program. At this time last year, we had completed security upgrades at only one nuclear facility in Russia, a civilian nuclear research facility at the Kurchatov Institute. We were very proud of that work and, as some of you may remember, we brought poster-sized before and after pictures of our work at the institute to show the committee. I am pleased to report to you that today, only 1 year later, we have achieved agreements with over 35 locations in the former Soviet Union and we continue to conclude agreements with additional sites at a rapid pace.

I brought along a graphic this morning, a posterboard that is directly behind Chris Williams. I apologize for putting it behind you, but there is a lot of detail on it that would be difficult to read from much further away. That captures in picture form——

Mr. HUNTER. We were trying to figure out whose congressional district that is. [Laughter.]

Ms. ROHLFING. It is not shaped like any of the ones that you are most familiar with. I think that captures very succinctly, gives you some feel for the number of sites where we have a presence today. Last year when we came before you, there would have only been one dot on that map. We also have on that poster, and you can look at it at your leisure later on, the listing of all of the names of the facilities that are now part of our Material Protection Control and Accounting Program.

Just one other metric about this program. Last year, when we testified before the committee, we had secured approximately 75 kilograms of highly enriched uranium. Since that last testimony, we have secured tons of nuclear material and will improve the security of tens of additional tons by the end of 1996. These are remarkable achievements by any measure, but even more so in light of the fact that our work with each facility must be done on a negotiated, cooperative basis.

Last year, based on a promise of progress and demonstrated success at only a single facility, the committee supported our budget request of $70 million for this fiscal year, fiscal year 1996. We believe we have delivered on and even exceeded our commitments to you last year. Based on this demonstrated record of achievement and the anticipation of continued rapid progress, we request the committee's support of $94.2 million for this program in fiscal year 1997.

The second nonproliferation highlight that I want to note for you this morning concerns a technological breakthrough that the Department achieved last summer. In the Department's nonproliferation [R&D] program, we are working to develop technologies that will allow us to detect the covert production of plutonium and highly enriched uranium by proliferant nations. A proliferant's most difficult step in developing nuclear weapons is the acquisition of weapons-grade plutonium and uranium. Our ability to detect covert, indigenous production of these materials is, therefore, critical to our ability to identify proliferation threats as they are emerging and essential to developing appropriate responses.

Today, our ability to detect covert materials production is limited by our ability to gain access or proximity to suspect facilities. One of the primary goals of our nonproliferation R&D program, therefore, is to detect the production of these nuclear weapons remotely, thus eliminating our dependence on access or proximity to a suspect facility.

At DOE, we are currently pursuing the goal of remote detection in a technology development program called CALIOPE. CALIOPE is a sensor system that will fly on an airborne platform, either a Remotely Piloted Vehicle or an aircraft, and detect the presence of chemicals that are indicative of nuclear materials production. Last summer, using prototype equipment set up in a field environment, we demonstrated the ability to detect chemicals of interest at a significant standoff distance. Based on this breakthrough, we are optimistic that within the next 4 years, we will complete technology development and field a new national capability for proliferation detection.

CALIOPE is only one example of the important work accomplished in our R&D program. The Department's nonproliferation R&D program is a unique program dedicated to providing the technologies and systems needed to monitor, detect, and characterize proliferation activities worldwide, both cooperatively and noncooperatively. Your support for the Department's fiscal year 1997 budget request of $195 million for nonproliferation R&D is vital to ensuring the Nation's continued capability to detect and deter proliferation, verify treaties, and respond to future challenges.

In closing, I would like to thank you again for the opportunity to appear today.

[The prepared statement of Ms. Rohlfing follows:]

Statement of Joan B. Rohlfing
Director
Office of Nonproliferation and National Security
Department of Energy
Before the Military Procurement Subcommittee
House National Security Committee

12 March 1996

Good morning Mr. Chairman and members of the subcommittee. It is my pleasure to address you today as the Director of the Office of Nonproliferation and National Security at the U.S. Department of Energy (DOE).

In recent years, the worldwide proliferation of Weapons of Mass Destruction (WMD) and their missile delivery systems has emerged as one of the most serious dangers confronting the United States. This is a continuing and evolving problem with broad consequences for international security and stability. At least 20 countries — some of them hostile to the United States — already have or may be developing WMD through the acquisition of dual-use technology, indigenous development and production, and/or support from rogue supplier states. Additionally, safety and security of existing nuclear weapons and materials are of increasing concern as economic and social pressures mount in countries such as Russia, Ukraine, Kazakstan and Belarus.

The President has made nonproliferation one of this nation's highest priorities. As the preeminent agency in nuclear materials and weapons technology and protection, the Department of Energy, through the Office of Nonproliferation and National Security, is uniquely suited to provide leadership in national and international efforts to reduce nuclear weapons worldwide; secure and prevent the spread of nuclear materials, technology and expertise; roll back nuclear weapons development programs; avoid proliferation surprise; and respond to nonproliferation emergencies. We particularly draw upon 50 years of science and technology expertise resident throughout the DOE National Laboratory complex to help us achieve these goals.

To reduce the international proliferation threat, the Office of Nonproliferation and National Security is focusing its resources and expertise on the following near-term priorities: ① securing nuclear materials, technology and expertise in Russia and the Newly Independent States; ② maintaining effective protection, control and accountability of nuclear materials, technology and expertise in the United States; ③ limiting weapons-usable fissile materials worldwide; ④ ensuring transparent and irreversible reductions of global nuclear stockpiles; ⑤ supporting the completion of a Comprehensive Test Ban Treaty in 1996; ⑥ developing and integrating a program for preventing, detecting and responding to nuclear terrorism and smuggling;

⑦ controlling nuclear exports; and ⑧ strengthening the nuclear nonproliferation regime. Through the unique scientific, technical, analytical and operational capabilities of the Department and its National Laboratories, we are working to effectively and efficiently accomplish these near-term priorities by marshaling and integrating our resources and nonproliferation activities.

Some of our most important international activities include: conducting the government-to-government and laboratory-to-laboratory programs of cooperation between U.S. nuclear experts and their counterparts at nuclear facilities and institutes in the former Soviet Union to improve the protection, control and accountability of nuclear materials; assisting Russia and the Newly Independent States in establishing and enhancing nuclear material export control systems; developing advanced technologies and systems to detect the indigenous proliferation of WMD, to enable the verification of arms control treaties, and to facilitate the collection of intelligence information in noncooperative environments; conducting critical operations in cooperation with the Democratic People's Republic of Korea to stabilize and safely store spent nuclear fuel thereby both freezing the North Korean nuclear weapons program and enabling the application of effective International Atomic Energy Agency (IAEA) safeguards; working with the private sector to engage WMD weapons scientists, engineers and technicians in the former Soviet Union in activities which reduce the proliferation threat; and providing technical support of long-term monitoring of Iraqi facilities and other nuclear safeguards and emergency programs of the IAEA. In addition, we are providing unique and in-depth technical, arms-control, intelligence, research and technology expertise as part of the U.S. Government's integrated efforts to conclude negotiations, prepare for entry into force, and implement a CTBT.

The Department's unique technical and analytical capabilities allow us to play a pivotal role in the weapons of mass destruction arenas of the U.S. Intelligence Community. For example, DOE continues to contribute to National Intelligence Estimates and to support the Intelligence Community's Non-Proliferation Center in assessing the activities of emerging nuclear weapons states and terrorist organizations, the activities of states that supply nuclear materials and expertise, and theft and smuggling of nuclear material.

In concert with our international activities, we are responsible for conducting a wide range of domestic activities that support our nonproliferation and national security goals. These activities include: directing a rigorous safeguards and security program for the entire Department of Energy complex, thereby ensuring the demonstrated security of our own nuclear materials, technology and expertise; declassifying millions of DOE documents while protecting critical information that has the potential to facilitate the proliferation of weapons of mass destruction; and maintaining a security investigations and reinvestigations program for both

Federal and contractor employees of the Department. We also provide technical, analytical, policy and implementation support to the efforts of the nation's policy community to deal with nonproliferation issues.

We also ensure the Department has a robust emergency management and response capability for nonproliferation, energy and nuclear emergencies. Through this program, we provide assistance to other government agencies as well as state, tribal and local governments. Over the past year, we have been providing emergency response experts to assist other foreign governments in reviews of their emergency preparedness plans and capabilities. Through the Partnership for Peace, we have been working with the Departments of State and Defense to assist Russia and the Newly Independent States to plan for and manage energy and radiological emergencies. We also have been working with the International Atomic Energy Agency, International Energy Agency and Arctic Environmental Protection Strategy to develop procedures and support plans for any radiological emergency.

ACCOMPLISHMENTS

Over the past year, we have demonstrated leadership and achieved significant accomplishments in each of our near-term priorities:

- ✓ In 1995, our cooperative efforts with Russia and the Newly Independent States in securing nuclear materials, technology and expertise, has protected over 8 tons of direct-use nuclear material with upgrades to 26 facilities' material protection, control and accounting programs. Before the end of 1996, we expect to broaden this effort to over 35 facilities and protect hundreds of tons of plutonium and highly enriched uranium. Additionally, we have begun discussions with the Russian Navy to begin upgrades on their nuclear facilities as well.

- ✓ We have engaged nearly two thousand weapons scientists, engineers and technicians on 219 scientific projects at 77 institutes in Russia, Ukraine, Kazakstan and Belarus to prevent a "brain-drain" of these scientists to other countries that would employ them for their own indigenous nuclear weapons programs.

- ✓ Our work in North Korea has effectively stopped their indigenous nuclear weapons development program. We have a team currently in country canning the spent fuel to prevent its reprocessing for use in nuclear weapons. Additionally, we have enabled the IAEA to apply international safeguards on the existing nuclear facilities remaining in North Korea.

- ✓ We are the sole agency responsible for developing technologies to monitor and verify a Comprehensive Test Ban Treaty. In 1995, we demonstrated significant progress in each of the sensor technologies required to support an international monitoring system: seismic monitoring, radionuclide monitoring, hydroacoustic monitoring, on-site inspection, space-based monitoring, and automated data processing. One particular success is our improvement of the capability to more easily distinguish nuclear explosions from earthquakes — a formidable step toward a greater verification capability.

- ✓ In 1994, the Office of Nonproliferation and National Security completed installation of sensors on all Global Positioning Satellites that allow the United States to continuously detect near-earth and atmospheric nuclear explosions and verify treaty compliance worldwide. In 1995 we began developing and deploying the next-generation of sensors to improve our detection capability.

- ✓ We have also completed the first comprehensive assessment of all the chemicals that might be used in a nuclear weapons life-cycle. This positions the United States to develop better techniques to detect an indigenous nuclear weapons program.

- ✓ Our declassification program has also played an instrumental role in furthering U.S. nonproliferation goals, especially in the initiative to achieve a bilateral agreement with Russia for the exchange of classified information to facilitate confirmation of transparent and irreversible nuclear weapons reductions.

- ✓ The Department's safeguards and security functions that were previously spread across the DOE complex are now consolidated within the Office of Nonproliferation and National Security. This achievement is an important step toward creating a responsive and efficient focal point for the Department's nuclear safeguards and security program and providing a national-level technical resource which is capable of fully supporting multilateral nuclear nonproliferation efforts.

LOOK TO THE FUTURE

With our many achievements, there is much work to be done in our long and short term priority areas. We cannot rest on our laurels and expect the global nuclear danger to reduce on its own. The programs of the Office of Nonproliferation and National Security seek to broaden their effects whereever they are able.

In the coming year and a half, the Department will accelerate efforts to provide enhanced materials protection, control and accounting for fissile materials in Russia and the Newly Independent States. We hope to complete all MPC&A improvements in former Soviet Union states outside of Russia by the end of calendar year 1997 (with the majority of work being completed by the end of the fiscal year). In Russia, we intend to expand cooperation to the remaining facilities in the civil nuclear complex while continuing work with facilities related to the nuclear weapon complex. Our efforts with *Gosatomnadzor* (the Russian agency equivalent to the U.S. Nuclear Regulatory Commission) to design and promote an indigenous MPC&A standards system will ensure that Russian weapons usable material will be protected after the U.S. involvement has been completed. The program as a whole anticipates upgrades at 50 locations in Russia and 13 locations in the Newly Independent States completed by the year 2002.

We are working to improve regional arms control and nonproliferation regimes through programs such as the Cooperative Monitoring Center (CMC) in Albuquerque, New Mexico. At the CMC, we assist political and technical experts from around the world acquire the technology-based tools they need to assess, design, analyze and implement nonproliferation, arms control and other security measures in their own regions. This particularly fosters regional security and lessens the desire for nations to acquire or develop their own weapons of mass destruction. We plan to further expand this effort with states of the Middle East, South Asia, the Koreas, and China.

In 1996, we hope to conclude an Agreement for Cooperation and a Stockpile Data Exchange Agreement with Russia that will allow us to gain insight into warhead dismantlement. These agreements will build confidence between our two nations that our mutual nuclear arms reductions are in fact occurring and irreversible.

These examples show that our activities are truly beneficial. Through our robust and cost-effective programs, we are able to provide leadership in the nonproliferation community, further the nonproliferation goals of the United States, and ensure the national security.

BUDGET REVIEW

The table below summarizes the fiscal year 1997 budget request for the Office of Nonproliferation and National Security from the Energy and Water Development Appropriation as compared with the fiscal year 1996 adjusted appropriation (in thousands).

Appropriation/Activity	FY 96 appropriated	FY96 comparable	FY 97
Program Direction[1]	—	$ 82,809	$ 95,622
Nonproliferation and Verification Research and Development	$ 216,142	210,718	194,919
Arms Control and Nonproliferation	160,964	145,057	181,244
Intelligence	42,336	30,957	29,185
Soviet-Designed Reactor Safety[2]	30,000	0	0
Nuclear Safeguards and Security	84,395	46,172	47,208
Security Investigations	20,000	20,000	22,000
Emergency Management	23,321	16,866	16,794
CONGRESSIONAL BUDGET REQUEST	*$ 577,158*	*$ 552,579*	*$ 586,972*

The Nonproliferation and Verification Research and Development budget request for fiscal year 1997 reflects a savings of $15.3 million. This savings in part is a result of our effort to eliminate duplication between agencies and within DOE, improving coordination between sponsoring agencies, streamlining operations and generating a meaningful cost savings.

The Arms Control and Nonproliferation budget request includes a net increase of $36.1 million concentrated in the area of material protection, control and accounting. This increase is due to the rapid pace of expansion of cooperation with Russian facilities and is important to ensure early safeguarding of weapons usable material at their source. We are also expanding our efforts in the Reduced Enrichment Research and Test Reactor (RERTR) and Industrial Partnering Programs. The increase will also allow us to ensure that the canned spent nuclear fuel in North Korea is not used in an indigenous nuclear development program.

---

[1] The Fiscal Year 1997 budget request includes a new Program Direction line item as mandated by the Energy and Water Appropriation for Fiscal Year 1996. This new budget line item provides funding for salaries and benefits, travel, support service contractors and other related expenses associated with the overall management and administration of the Office of Nonproliferation and National Security.

[2] The Soviet Designed Reactor Safety program is run by the Office of Nuclear Energy and funding for this program has been included elsewhere in the Other Defense Activities account.

Finally, the increase will provide increased analysis and support to: U.S. nuclear arms control policies in the Middle East, Asia and South Asia, nuclear energy security issues in Asia, South Asia and Europe, and U.S. policies to deal with excess civil plutonium.

The Intelligence budget request reflects a modest reduction from fiscal year 1996 resulting from realized efficiencies. The request will provide for timely, high-impact analysis and reporting on the proliferation implications of selected nuclear weapons states' programs, emerging nuclear proliferants, nuclear suppliers, and global impacts to the U.S. energy security.

The Nuclear Safeguards and Security budget request for fiscal year 1997 includes a net increase of slightly over $1 million. Through a requested increase and reprioritization of funding needs, we intend to increase the Classification and Declassification budget by approximately $2.3 million. This increase seeks to further develop advanced automation technology in support of the Declassification Productivity Initiative program and implement Executive Order 12958 on Classified National Security Information.

Finally, the Emergency Management budget request for fiscal year 1997 is unchanged from the fiscal year 1996 appropriation. The change reflected in the summary table above is exclusively a result of consolidation of Program Direction funds.

CONCLUSION

Preventing the spread of weapons of mass destruction is a crucial aspect of our national interest, and the Office of Nonproliferation and National Security is uniquely capable to serve this national interest, especially through the efforts of our national laboratories. Our science and technology base enables us to provide unique solutions to national and international nonproliferation problems. The work we do benefits the nation's security across a broad spectrum: protecting nuclear material in the United States and worldwide; rolling back existing nuclear weapons development programs internationally; ensuring the verifiability of nuclear treaties, especially a CTBT; and responding to energy and nonproliferation emergencies.

Mr. HUNTER. Thank you. As usual, Chris is in his typical role of assisting you.

I think what we will do is let us start with the laboratories. Dr. Smith, we will let you be the cleanup hitter here. We will just go from left to right. Dr. Robinson, thank you for being with us. We appreciate your service to the country and the floor is yours.

STATEMENT OF C. PAUL ROBINSON, DIRECTOR, SANDIA NATIONAL LABORATORIES

Dr. ROBINSON. Thank you very much, Mr. Chairman.

The laboratory at Sandia joins with our sister laboratories in a search for concept of how we can maintain confidence in the U.S. stockpile under a comprehensive test restraint. Our first priority is the stewardship of the stockpile. There is much vigorous activity at the laboratory, looking at life extension of a number of the weapons systems, some proof testing of a new modification of the B–61 bomb to replace something we have been wanting to get out of the stockpile for some length of time, the B–53.

We are also prototyping, after many years, a redesign of the safe secure transport with all of its technology that has provided safe transport of U.S. nuclear weapons. We also have taken some of that technology to the former Soviet Union and indeed have installed sensors in Russian rail cars to try and increase the security with which they transport weapons, as well.

In the area of support for the plants, we have just delivered a robotic disassembly unit to Pantex to try and decrease the risk and the exposure to workers in the intensive dismantlement work underway there.

Two major technical highlights, let me mention briefly. The first is in computation. Last year, we had set a speed record for computation. We have now extended that in a system which will be delivered this December, which will be by far the world's most powerful computer, nearly 2 trillion operations per second. It is a system that has 9,000 individual computers coupled together, working cooperatively in parallel, a major undertaking but should give a major boost to our ability to simulate the processes of nuclear weapons and is a key part of our moving forward to try and do more with computation and, hence, not have to rely on testing.

Similarly, we had a result we are trying to simulate in the laboratory, nuclear explosions. With one of our systems, we have now created by far the most powerful x-ray source representing bomb conditions, some 85 terrawatts of radiation. We see our way, based on the initial experiments, to scale up to very much higher energies. I think this will also be a workhorse in the laboratory.

You may be aware that Sandia began almost 30 years ago to try and find a way to do without underground nuclear testing for radiation effects of nuclear weapons. We made the investments in large pulse power facilities, and indeed, with all but one small region, we have been able to replace the work of underground testing with these above-ground facilities.

That is not a proof that such facilities can replace testing in total, but at least it is a guide of the direction of which we are trying to go. These are very major facilities. We are putting a lot of the diagnostics we used to use underground on these facilities, keeping the teams active thereby and I think making some substantial progress in our quest to see if we can substitute science-based work for the stockpile stewardship that relied on testing.

I will not say we are not challenged. This is a difficult time. We are searching for a concept of what is the right way to do it and we are also in fairly difficult budget times in doing that. I think, as was mentioned, we do not yet have a budget mark for our work. We were certainly pleased with the agreement we made with the President that had a number of conditions and a number of safeguards in that as the laboratory signed up to try and meet the challenge of science-based stockpile stewardship. Essential to that is having the budgetary support to carry out that work.

I think I will end my remarks there, sir.

[The prepared statement of Dr. Robinson follows:]

Statement of C. Paul Robinson, Director
Sandia National Laboratories

United States House of Representatives
Committee on National Security

Joint Hearing of the
Subcommittee on Military Procurement
and
Subcommittee on Research and Development

March 12, 1996

Introduction

Mr. Chairman and distinguished members of the committee, it is a pleasure to be able to testify to you today. I am Paul Robinson, director of Sandia National Laboratories. Sandia is managed and operated for the U.S. Department of Energy by a subsidiary of Lockheed Martin Corporation. We are, first and foremost, a defense programs laboratory, with responsibility for the engineering development of all U.S. nuclear weapons and for systems integration of the nuclear weapons with their delivery vehicles. National security programs and defense-related environmental programs for the Department of Energy constitute 65 percent of our laboratory's work. Our responsibilities embrace the design, certification, and assessment of the non-nuclear subsystems of nuclear weapons; safety, security, reliability, and use-control; issues associated with the production and dismantlement of nuclear weapons; surveillance and support of weapons in stockpile; and substantial work in nuclear intelligence, nonproliferation, and treaty verification technologies. We are, however, a multi-mission laboratory. Ten percent of our work supports DOE missions in energy science, research, and development. When appropriate, we also perform work for other government agencies, particularly the Department of Defense, in programs where unique competencies, built by our mission responsibilities, can add value.

I have been closely involved with the technical management of our nation's nuclear weapons program throughout most of my career. In the early 1980s, I directed Los Alamos National Laboratory's defense programs, with responsibility for nuclear weapons research, development, and testing; stockpile maintenance; strategic defense initiatives; inertial fusion; nuclear materials and safeguards; advanced conventional weapons; and arms control and verification activities. Prior to joining Sandia National Laboratories five years ago, it was my privilege to serve as chief negotiator and head of the U.S. delegation to the nuclear testing talks between the United States and the Soviet Union. Those negotiations, as you may recall, produced two major agreements: protocols to the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty. These were the last treaties to enter into force prior to the dissolution of the Soviet Union, but they remain in force today with the United States and Russia. Since becoming Sandia's laboratory director in August of last year, I have placed great emphasis on meeting the challenge of maintaining the nuclear weapons stockpile in these difficult budget and policy times.

On August 11 of last year, the President released a statement which included the Administration's commitment to maintenance of a safe and reliable nuclear stockpile:

> As part of our national security strategy, the United States must and will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. In this regard, I consider the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States.
>
> . . .
>
> I am assured by the Secretary of Energy and the Directors of our nuclear weapons laboratories that we can meet the challenge of maintaining our nuclear deterrent under a CTBT through a Science Based Stockpile Stewardship program without nuclear testing. . . . In order for this program to succeed, both the Administration and the Congress must provide sustained bipartisan support for the stockpile stewardship program over the next decade and beyond. I am committed to working with the Congress to ensure this support.

The President attached a fact sheet to his statement that outlined a set of Safeguards, A through F, that state the conditions under which the United States can enter into a comprehensive test ban treaty (CTBT). In January of this year, in ratifying the START II treaty, the Senate included within the ratification bill a similar set of Safeguards [(c)(12)(A through F)] that also state an enduring commitment to maintaining a robust stockpile:

> The United States is committed to proceeding with a robust stockpile stewardship program, and to maintaining nuclear weapons production capabilities and capacities, that will ensure the safety, reliability, and performance of the United States nuclear arsenal at the START II levels and meet requirements for hedging against possible international developments or technical problems in conformance with United States policies and to underpin deterrence.

Sandia has major responsibilities in ensuring confidence in the safety and reliability of the United States' nuclear weapons stockpile and for ensuring that this vision for the START II stockpile is achieved. I was particularly pleased when the President made his commitments to the nuclear weapons stockpile and to then see similar safeguards also embraced by the Senate. Throughout my career it has seemed to me vitally important that the Executive branch and the Congress achieve agreement on nuclear weapons issues. I have always believed that the nation is best served when its ultimate defense, its stockpile of nuclear weapons, is not the subject of partisan contention. I thus find much satisfaction in the consistency of support for our mission by both the White House and the Congress.

Current Stockpile Support Work

Many people suffer from an erroneous perception that the DOE defense programs laboratories have very little work to do right now. Nothing could be further from the truth. The challenges of stockpile stewardship are formidable, particularly in an era of no new weapon designs and no nuclear testing. We have several important projects underway with deliverables due in the next one to three years:

- We are currently engaged in a life extension program for the W87 Peacekeeper missile warhead.
- We are nearing completion on a quality improvement program for the B83 bomb, which will extend the service life of this weapon.
- We are developing Mod. 11 of the B61 bomb as an operational substitute for the aging B53 bomb. This is not a new weapon development program; it is a field retrofit of B61 Mod. 7 components. The Mod. 11 will ultimately permit us to retire the B53.

- We are performing modifications to other versions of the B61 to sustain the reliability scores that have been typical of these weapons in the past. At the same time, we are performing upgrades in their safety and use-control systems.
- We are nearing completion on a prototype redesign of the Safe Secure Transport vehicle used by DOE to transport weapons on the highways. The redesigned Safe Secure Transport will support DOE's growing weapon retirement program during the next several years.
- We are collaborating with the other defense programs laboratories and the DOE Pantex plant (which performs weapon assembly and disassembly) to develop methods to disassemble and dispose of weapon components safely and in compliance with environmental requirements.

Much of our current stockpile activities can be characterized as life extension work. With no new weapon developments planned for the foreseeable future, we will be required to support the weapons currently in stockpile well beyond their designed service lives. We are developing an enhanced stockpile surveillance program to help us plan our life extension activities in an optimum fashion.

The warheads and bombs that will constitute our stockpile under START II were all developed and produced within a rather limited time span; many of them contain similar parts and components and were produced with similar processes. This increases the possibility that portions of the aging stockpile could be subject to common failure modes. The enhanced stockpile surveillance program is designed to help us identify this danger early. In cooperation with the Navy Fleet Ballistic Missile Systems command, we are investigating options for coping with the design and production implications of such situations for navy weapons.

A major undertaking in stockpile life extension work is the dual revalidation program we are conducting with our sister defense programs laboratories, Los Alamos and Lawrence Livermore, under the joint sponsorship of the DOE Assistant Secretary for Defense Programs and the Assistant to the Secretary of Defense for Atomic Energy. This program will examine and update the design information for every weapon type in the stockpile, including its interface with the delivery system. Since we no longer have available the use of underground testing to validate design performance, the responsible laboratory team for each weapon will comprehensively examine the extant design data using the best design definition tools and methods available to us today. Any missing or incomplete elements in the documented design will be investigated and completed. The revised design data package of drawings, specifications, computer codes, and other documentation will then be given to a design team from a different laboratory for their critical review. In this way, two independent design teams will evaluate the design data package for each weapon in the enduring stockpile and ensure that it is complete and current with modern engineering standards, including the new computational engineering methods.

The stockpile activities I have described here are part of our enduring responsibilities in stockpile stewardship and management. As you can see, this job requires constant engineering support.

Maintaining Production Capabilities

Safeguard B of the Senate's START II ratification bill also makes a commitment to maintaining the necessary production capabilities to support the stockpile:

> The United States is committed to reestablishing and maintaining sufficient levels of production to support requirements for the safety, reliability, and performance of United States nuclear weapons and demonstrate and sustain production capabilities and capacities.

Clearly, to ensure that the stockpile remains safe, secure, and reliable, the nuclear weapons complex must reestablish a modern production capability to repair, requalify, or rebuild warheads and bombs. This can be achieved within DOE's plan for a smaller nuclear-weapon production complex. We vigorously support DOE's program for Advanced Design and Production Technologies (ADAPT) both at the production plants and in the laboratories. ADAPT will develop an affordable design and production capability for DOE that keeps pace with manufacturing technology in industry, on whom we increasingly rely to supply weapon components.

It should be emphasized that the nuclear weapons program requires an intimate relationship between the laboratories, where the technology is developed, and the production plants that manufacture nuclear weapons. Sandia works closely with DOE's production agencies. We design or specify nearly all of the non-nuclear components of nuclear warheads. We support the production engineers at Allied Signal, Kansas City Division, who are responsible for manufacturing many of our components, and the engineers at the Pantex plant in Amarillo, where warheads and bombs are assembled or disassembled. We also produce a limited number of two kinds of components in-house, as a result of recent plant closures in the DOE complex. We have the additional assignment for manufacturing development engineering of twelve other weapon component technologies, for which we are DOE's production agent. We are working closely with industry to develop suppliers for these components.

For a variety of security, business, or technical reasons, it is impractical to rely on industry for all the components required for nuclear weapons. This is particularly true for components that are produced in low quantities and are unique to nuclear weapons. Consequently, DOE must retain an in-house manufacturing capability. To most effectively use these capabilities, new or improved processes and materials are being developed to enhance efficiency and minimize wastes, environmental impacts, and cost, and provide greater worker safety.

Maintaining Laboratory Nuclear Weapon Competencies

The Senate's START II ratification bill also makes a commitment "to maintaining United States nuclear weapons laboratories and protecting the core nuclear weapons competencies therein" (Safeguard C).

The nuclear weapon laboratories were created to ensure that the best technical direction would be made available to the nuclear weapons program and that technical responsibility for the stockpile would reside with identifiable institutions directly accountable to government authority. Early on, the framers of the Atomic Energy Act decided that the technology of military applications of nuclear energy should be closely held. There is no industrial utility to this technology. This technology is not taught in the universities. The expertise for U.S. nuclear weapons resides only at these laboratories. Nuclear weapons can only be produced and their surety maintained under the supervision of these laboratories. Indeed, our confidence in the weapons that are deployed in the stockpile depends upon the continuing strong capabilities of the people who staff the DOE defense programs laboratories.

During the cold war, a continuous stream of new weapon development programs permitted us to continuously exercise and improve our capabilities. When problems were encountered in the stockpile, we had experienced designers on hand with the skills to fix them. However, in the future, the engineers who will perform stockpile support and stockpile extension programs will not have had original weapon system design experience. We are moving from experience-based stockpile management to science-based stockpile management. This shift makes the scientific capabilities of the laboratories more important than ever.

One of the major long-term challenges we face is how to ensure the reliability of an aging stockpile. We oversee the stockpile to ensure that weapons continue to be reliable, that they are safe, and that they are upgraded as necessary to maintain their capabilities until they are retired. Unfortunately, we do not possess sufficient data on how reliability declines as systems get older than about 20 years. However, it will soon be our daunting task to ensure that systems remain reliable and safe for decades beyond their designed service lives.

To do this job, we must scientifically understand the parameters of aging in electronics, materials, and structures in order to both anticipate failure paths and to provide for timely upgrades, replacements, and rebuilds. We are vigorously exploring ways of leveraging science to help meet our stockpile obligations in this regard.

Computational Modeling and Simulation

One of the great levers of science is computational modeling and simulation. Over the past two decades, advances in computer and information technologies have led to a thousand-fold increase in computing capability. At the same time, the sophistication of our computational software and algorithms for scientific problems has undergone similar increases. Nevertheless, even the commercially available and laboratory technologies of today are inadequate for the stockpile stewardship tasks we will face in the future. Another hundred-to-thousand-fold increase in capability from hardware and software combined will be required.

The Department of Energy's three nuclear weapon laboratories are undertaking a bold initiative in partnership with the U.S. computing industry and with American universities to accelerate the development of strategic computing resources required for their missions. This program, the Accelerated Strategic Computing Initiative (ASCI), builds on DOE's leadership in new computing methods and on industry's development of new kinds of supercomputers. The Accelerated Strategic Computing Initiative seeks to advance the development of computers capable of hundreds of trillions of operations per second (hundreds of teraflops) by five-to-ten years. It will also develop a new generation of full-physics, three-dimensional computer simulation tools that are needed for our goal of simulation-driven life-cycle engineering. These tools will be developed at the three laboratories in collaboration with U.S. research universities and software firms.

The first step in the Accelerated Strategic Computing Initiative has been a partnership led by Sandia and Intel Corporation to develop the world's first teraflop computer. This project, which builds on previous Intel partnerships with Sandia and Oak Ridge National Laboratories, will field a computer at Sandia in 1996 with over 9,000 individual processors tightly coupled together. It will have ten times the memory (nearly 600 billion bytes) and ten times the speed (over 1.8 trillion operations per second) of any previous machine. This computer will immediately contribute to detailed safety, aging, and nuclear performance studies engendered by real stockpile problems we are dealing with now. It will also be used by the three defense programs laboratories to develop and test the highly detailed software models needed for science-based stockpile stewardship.

Preserving Design Competencies

In my view, we will someday have to replace old weapons with entirely new systems; we cannot extend their service lives indefinitely. But replacing systems with exact replicas would neither be cost-effective nor technologically feasible. New designs for components and subsystems will be a continuing requirement which will require all the original core competencies we needed to make new weapon designs, as well as contemporary capabilities in advancing technology.

We can see from our planning charts that many of the systems in stockpile will require replacement at about the same time at some point in the first half of the next century. The engineers and scientists who will do that work are probably entering kindergarten this year. No old-timers will be around in 2025 who have had actual experience in designing a warhead. We must find ways to qualify these people. They need to work on real systems. We cannot expect them to acquire critical design skills merely by performing piecemeal component replacement work and development simulations. They have to design whole systems with real deliverables to fully develop their capabilities. Ideally, we would like to train our junior weapon design engineers alongside experienced engineers, but this will not be possible during a decades-long hiatus of no weapon development. The Russian laboratories, by contrast, will be able to pass along their critical weapon design skills to a new generation under their announced plans to rebuild thousands of weapons each year.

Strategy for the Future

It is my belief that nuclear weapons will remain important for a long time to come, and I intend to manage Sandia National Laboratories strategically so that it can continue to perform its responsibilities over the long term. We must maintain and continuously improve our technical competencies required for this work. To do so, it is my view that the following two strategic principles must be observed:

1. *We must stay current with advances in science and technology.* Managing our nuclear weapons requires advanced technology, some of which is specific to nuclear weapons, but most of which is common to the standard science and engineering disciplines. If we don't keep up with the advancing frontiers in electronics, information science, materials science, and so forth, we won't be able to perform our mission in the long term.
2. *We must operate as a multiple-mission laboratory.* The nuclear weapons mission requires the stimulus and synergy of a multidisciplinary technical environment to be vital. The days of a high-volume nuclear weapon enterprise are over, but the requirements for laboratory excellence and a robust infrastructure remain. Only in the context of serving multiple missions can such an institutional environment be sustained.

The DOE laboratories cannot be an island; we must interact extensively with industry and universities. The technology bases for government and commercial needs are rapidly converging. I am firmly convinced that collaboration with industry and universities is essential for the DOE laboratories' mission success. Sandia's progress in establishing mutually beneficial relationships with the private sector is evidence of substantial congruence between its essential core competencies and those of industry.

Cooperative work with industry often helps support strategic technologies that address weapons programs needs in the long term. For example, electronics technology is critical to the

DOE defense mission, and it is especially important for Sandia's responsibilities in component design. Special-purpose electronic components in nuclear weapons include coded switches that prevent unauthorized use, tamper detectors, programmers that control the arming and firing sequence of the weapon, radars, and fuzing and firing sets. These devices must operate reliably over a large temperature range, survive strong mechanical shock, and be fully functional following exposure to intense pulses of ionizing and electromagnetic radiation.

DOE's requirements for many electronic devices cannot be met with commercial products. To meet its mission requirements, Sandia has developed a broad-based competency in electronics, from the fundamental science of semiconducting materials to device design and manufacturing. We can only maintain this capability in partnership with industry, and our program collaborates intensely with the semiconductor industry and universities through consortia and other arrangements. We have a five-year, $100 million cooperative research and development agreement with the Sematech consortium, as well as several other cooperative agreements with individual semiconductor companies. These arrangements are strategically important to the weapons program.

In my view, a multiple-mission, multidisciplinary environment is absolutely essential for excellence in the DOE national laboratories. The science and technology requirements for the nuclear weapons mission are extremely broad, covering most of the physical sciences and engineering disciplines recognized today, as well as the computational and supporting technologies required for modern scientific investigation. A world-class base of scientific and technological excellence has always been the critical factor in meeting the extreme requirements placed on nuclear weapons, especially in regard to weapon safety, security, and reliability. The laboratories' ability to sustain this base has been made difficult over the last several years by declining weapon R&D funding. At Sandia, our approach to dealing with this problem has been a strategy of supporting multiple missions from a central set of core technical competencies. A strong commitment to a common set of core competencies serving the needs of, and supported by, a diverse spectrum of customers has become an essential strategy for the defense programs laboratories. It has been a critical factor in our ability to support DOE's national security mission, as well as DOE's missions in energy, environment, and the basic sciences.

Tritium Production

Safeguard D of the Senate's START II ratification bill makes a commitment to "ensuring rapid access to a new production source of tritium within the next decade."

Tritium decays in stockpiled weapons and must be periodically replaced. A reliable, long-term source of supply for tritium is essential for maintaining the stockpile. Without tritium, our current weapons would have no military utility. To meet stockpile needs, DOE is currently recycling tritium recovered from dismantled weapons. Based on current long-range planning assessments, we will need to have a new production facility for tritium in place before 2005. We must get started now and move quickly. We believe it is prudent policy for DOE to pursue both the commercial reactor and accelerator options. Ironically, the more technically mature method, reactor production, may be stymied by legal impediments caused by our own government policies.

Sandia is actively supporting DOE with the technical planning and integration for tritium production using commercial light-water reactors. DOE's Idaho and Pacific Northwest laboratories are also involved, each contributing in a particular sphere of expertise. Sandia is the only defense programs laboratory playing a major role, however, so we feel that we have an important responsibility to help make it succeed. The Savannah River plant in South Carolina also is a major contributor, and we have established a strong working relationship with them. We are able to utilize nuclear engineering capabilities that exist at Sandia in testing and infrastructure planning, and we are establishing a teamwork relationship with the other participants. Sandia is also supporting Los Alamos National Laboratory with key elements of the accelerator approach, particularly in safety, health, and environmental design issues. In addition, we have much technical experience in the design of systems for safely transporting nuclear materials, a competency that will be important in the tritium program.

The Test Ban and Stockpile Confidence

Finally, safeguard provisions E and F of the Senate's START II ratification bill reserve the right of the United States to resume underground nuclear testing to maintain stockpile confidence if warhead design flaws or aging problems occur "that a robust stockpile stewardship program cannot solve," or if the supreme national interests of the United States are at risk.

You are of course aware that the President has decided to pursue a comprehensive test ban treaty. In contemplating this decision, he consulted with the directors of Los Alamos, Lawrence Livermore, and Sandia, the nation's three nuclear weapon laboratories. We told the President that we felt we could meet the challenge—and it will be a challenge—of maintaining the nation's nuclear deterrent under a comprehensive test ban *if* we vigorously pursue a program of science-based stockpile stewardship. We did not guarantee that we can meet that challenge in the absence of a strong commitment to science-based stockpile stewardship. This commitment will require sufficient funds to support the core program for maintaining the stockpile as well as an investment in special facilities required to perform our work in the absence of underground nuclear tests.

Today's budget hearing is unique in that we have not yet received a final budget mark to know whether an adequate level of funding will be provided to support the nuclear weapon programs. Science-based stockpile stewardship represents the soundest approach of which we are aware to ensure a safe and reliable stockpile without carrying out nuclear tests, and I committed our laboratory to do all that is humanly possible to make it succeed. While we in the laboratories will do our part, we have no chance of succeeding without adequate financial support. We were realistic in telling the administration that the quest to find a substitute for the role of nuclear testing cannot be pursued without an increase in funding, and I was satisfied with the President's commitment and support for the science-based stockpile stewardship initiative. The President made three commitments in this regard: adequate funding, an annual joint review of certification, and identification of "the maintenance of a safe and reliable nuclear stockpile" as a "supreme national interest of the United States."

I urge this committee's close attention to these issues. Although we have not received a budget mark for fiscal year 1997, there are many people in the administrative/budgetary line between the laboratories and the President. It is important that these individuals, all of whom are faced with difficult budget tradeoffs in this year of decreasing federal expenditures, not fail to fulfill the President's commitments. I assure you that this is also a question in which great care must be taken so we do not sacrifice the nation's future security by allowing the U.S. nuclear weapons stockpile to erode while we attempt to find ways to maintain confidence in our weapons without nuclear testing.

Radiation Effects Testing Through Laboratory Simulation

Ensuring confidence in the stockpile without nuclear testing will be especially challenging for the nuclear design laboratories, Los Alamos and Lawrence Livermore, because some aspects of nuclear explosives design are still not understood at the level of physical principles. Sandia is in a somewhat better position for fulfilling its responsibilities without nuclear testing because our design responsibilities include only the nonnuclear subsystems. We are still able to test in valid ways the electronic subsystems that must function reliably to ensure the safety, security, and controlled use of all U.S. nuclear weapons.

Nevertheless, we do have a continuing responsibility to assure that a warhead's electronic systems are viable in the extreme radiation environments of nuclear explosions. In the past, we have relied on nuclear testing for such assurance. However, over the past thirty years we have developed unique high-energy accelerators that permit us to simulate almost all of those radiation conditions in the laboratory. Thus, the steps to achieving substitutes for the full range of underground radiation effects tests of the past are underway in our science-based stockpile stewardship plan.

The requirements for such radiation sources include radiation sciences, ablation and implosion physics, and radiation flow phenomena. Progress has been steady over this long period through advances in engineering and science, but our progress has been spectacular during the last year as a result of our improved diagnostics and theoretical understanding. In recent experiments on Sandia's Saturn accelerator, we were able to create a one-half-million-joule x-ray source in a large-volume cavity and use that source in experiments with Los Alamos for radiation physics experiments. This result is particularly remarkable when you consider that the energy source was only 5 million joules and the conversion to a variable pulse x-ray source was 10 percent. The Saturn accelerator operating with an electrical power of 20 trillion watts was able to compress the pulse through an imploding plasma to achieve an x-ray power of 85 trillion watts! This result has been modeled by Lawrence Livermore National Laboratory.

We predict that our results should be substantially improved by applying the same approach on the larger Particle Beam Fusion Accelerator (PBFA) accelerator later this year, giving over 1.5 megajoules of X-ray output. If this step is successful, then we can begin to study issues of implosion symmetry and stability using this powerful and efficient source of x-rays. If that vital scaling step is successful, we think another factor of four in energy should be achievable in a fairly short time (5-10 years) with a reasonable expenditure (approximately one hundred million dollars). A modular building block of this advanced accelerator will begin operating this year, and when combined with the joint experiments with Los Alamos and Lawrence Livermore National Laboratories on the PBFA accelerator, we should have the basis for a decision on whether to proceed with this next step in order to produce hundreds of trillions of watts of radiation in the laboratory.

Radiation effects are already one example that can be put forward as a science-based alternative to testing. This initial success should give us hope, although it can not yet give us assurance, that a program to replace underground nuclear testing with laboratory experiments can be successful.

Inertial Confinement Fusion (ICF) and Treaty Limitations

I am concerned that some recent policy discussions regarding the content of a comprehensive test ban treaty could restrict the laboratories' ability to conduct an adequate stockpile stewardship program in the absence of testing. If the Arms Control and Disarmament Agency decides to seek provisions in a test ban treaty that restrict inertial confinement fusion (ICF) to *only* laser and particle beam drivers, based on the negotiating record of the 1975 Nonproliferation Treaty, then other methods of driving ICF, some of which are being aggressively developed here and abroad, would be treaty violations.

Some would have the United States take the extreme position that inertial confinement fusion is incompatible with a zero-yield policy. This contention has been thoroughly studied in the past and found to be without merit. The yields of ICF are so small that they fall well within the intent of a zero-yield policy, and they certainly do not present a proliferation threat. Further restrictions on ICF are not at all necessary for the purposes of the testing treaty. Moreover, inertial confinement fusion is recognized worldwide as an important experimental tool for the study of high-energy-density physics.

If the ICF language of the 1975 Nonproliferation Treaty were to be carried over to a comprehensive test ban treaty, some of the high-energy accelerators the laboratories use today to simulate a variety of radiation conditions, and some that will be needed in the future, would have to be abandoned. Such restrictions were not part of the laboratory directors' understanding when we told the President we could perform our missions without underground nuclear testing. Our clear expectation was that further limitations would not be placed on our ability to employ the various approaches to inertial confinement fusion in support of the stockpile stewardship efforts. In my view, it is essential that inertial confinement fusion be permitted under a CTBT without such restrictions.

Non-nuclear Stockpile Assurance Testing

At Sandia, we also assure stockpile confidence through non-nuclear assessment. This stockpile evaluation activity involves both laboratory and flight testing of stockpiled weapons, as well as designing test equipment and monitoring test performances. Test results that identify deviations from weapon performance standards are thoroughly investigated and may result in recommendations for stockpile improvement programs.

Joint testing of weapons in their delivery modes is performed in cooperation with the Department of Defense. We have recently become concerned about DoD budgetary constraints and other complications within the DOE weapons complex that affect the ability of the laboratories and the military services to support the joint DOE/DoD Stockpile Surveillance program. Difficulties in reconfiguring stockpile weapons at Pantex, while the facility was prohibited from operations under restraints of the Defense Nuclear Facilities Safety Board, delayed certain tests for significant periods. For several years Sandia has also been concerned over possible Air Force strategic missile testing shortfalls that could impact the reliability and credibility of W62, W78, and W87 warheads. A recent Joint Test Working Group meeting between the testing organizations of the departments of Energy and Defense has heightened that concern. Moving from multiple to single reentry vehicle configurations, eliminating Peacekeeper flight testing, and a decision not to combine reentry vehicle and warhead telemetry tests, are developments that reduce flight opportunities for nuclear warhead surveillance.

A similar test support problem may be developing for tactical bombs (B61 Mods. 3, 4, and 10). At a recent Air Force scheduling meeting of DOE, Sandia, and Air Force test organizations, it was revealed that no funding will be provided by the Air Force to support the tactical aircraft and range resources required for nuclear bomb test drops beginning this year.

My concern over these issues is based on Sandia's forty-plus years of test experience with nuclear warheads. We have sized our stockpile surveillance program to yield results within significant parameters. This requires us to test eleven warheads per year of each type. Generally, eight laboratory tests are conducted by Sandia at the Pantex plant and two to four flight tests are conducted jointly with the military. From a study of historical warhead data, we find that approximately 22 percent of the defects discovered in tests are flight-unique; that is, if we don't do flight tests we will likely not see that portion of defects within the system. Given the stringent reliability requirements that nuclear warheads must meet, we have determined that the minimum requirement for warhead flight tests is in the range of two to four per year.

We believe that a nuclear warhead assurance program that does not perform flight tests, or performs fewer flight tests than the minimum required, would lack a credible basis for evaluating system reliability. The credibility of reliability testing diminishes as the number of flight tests decreases. Erosion of credibility in our reliability testing program is serious, and would directly undercut the maintenance of confidence in the stockpile. I urge you to ensure that funding to support the joint flight test capabilities is maintained at an adequate level.

Summary and Conclusion

Sandia National Laboratories and our sister laboratories have a central and critical role to fulfill in DOE's stockpile stewardship and management program. It is our job to assure confidence in stockpile safety and reliability and help DOE create an effective and efficient production complex for the smaller stockpile of START II. We are dedicated to providing the engineering leadership to provide for long-range support of the enduring stockpile as it ages and as old technologies are superseded by new ones.

To do this job, we must sustain a robust core capability in the scientific and engineering disciplines required to respond to emerging and unforeseen challenges relating to nuclear weapons. Yet today that core capability is threatened by erosion of the budget support that we and the White House had agreed were essential to maintain the nuclear stockpile as a supreme national interest of the United States. This comes after a five-year budget trend that reduced the core nuclear weapons funding by nearly half. Similarly, we face other policy challenges ranging from the ability to produce tritium in commercial reactors to the prohibition of certain laboratory experimental facilities under new treaty restrictions.

Our laboratory stepped forward to sign up to the challenges of a new future in which the ultimate security of the nation will be bet on a program of science-based stockpile stewardship, without nuclear testing, rather than on the paradigms of the past. In truth, we are in a precarious position today throughout the nuclear complex to try and meet these challenges without adequate support to carry out the many complex tasks necessary to maintain the vital responsibilities which we must perform for the nation.

Mr. HUNTER. Thank you, Dr. Robinson.

Dr. Tarter, how is Livermore doing?

STATEMENT OF C. BRUCE TARTER, DIRECTOR, UNIVERSITY OF CALIFORNIA, LAWRENCE LIVERMORE NATIONAL LABORATORY

Dr. TARTER. We will find out after this year's hearing, sir.

Let me join with both the Departmental witnesses and my colleagues, Dr. Robinson and Dr. Hecker, in urging very strong support of the Stockpile Stewardship and Management Program proposal before you in the budget and also the work in nonproliferation and national security Ms. Rohlfing talked about.

I think this is not a hard problem to define. It is a hard problem to do. The problem to define is fairly straightforward. We have an existing stockpile which is coming down at a certain rate, which will be argued over and worked through in concert with policy people, and as that stockpile exists today and as it exists in the future, our job is to maintain confidence in its safety and reliability. So the problem is well posed.

There are three tenets, some of which you have alluded to in your statement, about how we do that. The first thing, because it is an existing stockpile, is to take everything we can from the past, all of our test history, all of the information we can extract, and turn that into information and knowledge to use in future assessments. That is a major job. It relies on the core parts of the laboratory that have built that stockpile and transfer that wisdom into the future.

The second part, without nuclear testing, is to assess what happens as that stockpile ages and as things happen to it in the future. What is proposed as part of the budget proposal before you and the basic Stockpile Stewardship Program are a variety of tool and capabilities that we believe will be necessary to make those assessments in the absence of nuclear testing. Our laboratory is very strongly supportive of the advance computation part of that initiative.

We also have a special responsibility for a Contained Firing Facility and for the National Ignition Facility, which we think are central to making those assessments. So the second part of our job is assessing whether a change, as Dr. Reis described, matters or not to the safety and reliability of the stockpile.

The third job we have is if we decide that a change is very serious or in the process of aging that a change needs to be made, we need the manufacturing and the change capability to implement those things within the stockpile, in other words, a production complex that can make those changes become reality.

I think one of the hardest parts of our job is to take on this third component in an active partnership with the plants that have built much of the existing stockpile and do it using the best of American technology and every piece of scientific and engineering skill we have to do this in a way which is modern, which is cost effective, and which is environmentally reasonably benign, and that is a very difficult challenge.

I think in my own written testimony you will see an example where we are working very hard with the Y12 plant at Oak Ridge to bring modern technology into a way to make some of those changes in parts of the stockpile for which we have special responsibilities.

So I think those, in my mind, are the three components of how we will do our work. I think the hard thing for all of us is to balance the investment strategy in those three pieces as we go forward into the future.

I would join very strongly with Dr. Robinson in saying that I think, and I think this occurred in our conversations with the members of the administration last year in signing up to the challenge of doing this job without nuclear testing, that the sustained bipartisan support for both the elements of the program and the dollars that go with it are absolutely essential to us being able to meet that commitment.

I think you can ask for from us a great deal in the way of managing well within this complicated problem and I think what we need back from you is the strong bipartisan support and enough flexibility to accommodate to the fact that this is not simply a simple job laid out. It is going to be one where we are going to learn. I think Mr. Curtis referred to the dynamic nature. We have to be able to make changes and manage according to sense and technical things that happen and have enough flexibility to manage within those things and a strong enough budget. Therefore, I very strongly urge your support of both the program and flexibility.

Ms. Rohlfing has already spoken about her area. I think a particular new initiative we have been very focused on this year is to worry about a particular phase in the nonproliferation area of the nuclear smuggling and I am very pleased during the last year that Livermore has taken the lead in suggesting a variety of forensic and other center technologies to help in the R&D efforts which she has talked about.

With that, I think I will pass it on to Dr. Hecker.

[The prepared statement of Dr. Tarter follows:]

THE DEPARTMENT OF ENERGY'S BUDGET REQUEST FOR FY 1997

Hearing of the Subcommittee on Military Procurement
Committee on National Security
US House of Representatives

March 12, 1996

C. Bruce Tarter, Director
University of California
Lawrence Livermore National Laboratory

INTRODUCTION

Mr. Chairman and members of the subcommittee, I am the Director of the Lawrence Livermore National Laboratory (LLNL). We were founded in 1952 as a nuclear weapons laboratory, and national security continues to be our central mission.

I am here today to support the Stockpile Stewardship and Management Program being pursued by DOE Defense Programs at the three national security laboratories (Livermore, Los Alamos, and Sandia), the Nevada Test Site, and the production facilities in the nuclear weapons complex. I intend to highlight how Livermore fits into this highly integrated program whose goal is to maintain confidence in the safety and reliability of the enduring US nuclear weapons stockpile. I am also here to support another aspect of our global security work—our important contributions to national efforts in nonproliferation, arms control, and international security. Largely sponsored by the DOE Office of Nonproliferation and National Security, these analytic, policy-support, and technology-development activities build on and reinforce nuclear expertise resident at Livermore. We are a "full-service" nuclear weapons technology laboratory—committed to both maintaining the enduring US nuclear weapons stockpile and dealing with the dangers posed by nuclear proliferation in the post-Cold War world.

During this past year, the President reached two critical decisions that established the course for future nuclear-weapons activities in the United States. First, the President announced on August 11, 1995, that the US would pursue a Comprehensive Nuclear Test Ban Treaty (CTBT) with no permitted nuclear weapon test explosions. In making that decision, he also reaffirmed the importance of maintaining a safe and reliable nuclear weapons stockpile. Then, on September 25, 1995, the President directed necessary programmatic activities to ensure continued stockpile performance:

> "To meet the challenge of ensuring confidence in the safety and reliability of our stockpile, I have concluded that the continued vitality of all three DOE nuclear weapons laboratories will be essential... In accordance with this conclusion, I have directed the Department of Energy to maintain nuclear weapons responsibilities and capabilities adequate to support the science-based stockpile stewardship program."

The mandated science-based Stockpile Stewardship and Management Program is a cost-conscious, integrated response to several highly significant changes since the end of the Cold War. It includes *enhanced stockpile surveillance* because the enduring stockpile is smaller, continues to grow older, and includes fewer types of weapons. To compensate for no nuclear testing, it includes *a revalidation process* to assess stockpile performance when physical changes are noted (or predicted) and to devise and validate remedial actions when they are needed. This process relies on a more fundamental understanding of nuclear weapons issues, better nonnuclear experiments, and more sophisticated computer simulations. In addition, for a production complex that is currently in need of modernization, the Program includes *an agile manufacturing capability* to refurbish and replace aging and defective components in an affordable and environmentally-responsible manner. Finally, the Program also includes the supply of tritium for weapons.

The Stockpile Stewardship and Management Program is a major technological undertaking that requires the integrated efforts of all aspects of the weapons complex. It also requires adequate investment—on the order of $4 billion per year for a decade—and flexibility to achieve a proper balance among the aforementioned program elements. Maintenance of confidence in the reliability and safety of the stockpile will suffer if we overinvest in one area at another's expense. There is no single "silver bullet" which can supersede the full set of integrated needs. Greater funding would increase the likelihood that this very challenging Program will succeed; conversely, less funding will increase risks. It is exceedingly important that we have a strong start in the early years to ensure the Program's success.

Program success also requires effective partnerships among the laboratories and between the laboratories and the production facilities. For the taxpayers' benefit, we must ensure that the special skills and unique facilities existing at one site are used efficiently to help work issues at another site. My testimony will include examples of partnerships that Livermore is pursuing with the other laboratories, with the Nevada Test Site, with the Y12 Plant, with the Department of Defense, and with American high-technology industries.

Livermore's global security responsibilities extend beyond stewardship of the US nuclear weapons stockpile. In his statement about a CTBT on August 11, 1995, the President emphasized the importance of pursuing:

> "...a comprehensive research and development program to improve our treaty monitoring capabilities and operations [and] continuing development of a broad range of intelligence gathering and analytical capabilities and operations to ensure accurate and comprehensive information on worldwide nuclear arsenals, nuclear weapons development programs, and related nuclear programs."

The proliferation of weapons of mass destruction represents a major challenge to our national security, and countering this threat requires a multi-pronged approach. DOE and its laboratories provide expertise and technology to support arms control policy development, arms control verification, and intelligence analysis of nuclear weapons activities worldwide. Livermore has played a very prominent role in these efforts, and we are undertaking leadership roles to counter the emerging threats of nuclear smuggling and nuclear terrorism. To help prevent theft of nuclear materials, we are also heavily involved in activities to improve fissile material control and facilitate nuclear weapons dismantlement in Russia.

The technical issues we face in stockpile stewardship and management and in nonproliferation and arms control are extremely challenging. They place significant demands on Livermore's scientific and engineering excellence. I will discuss each of these mission areas in turn, with examples of partnership activities and new initiatives. I will then mention some laboratory management issues and close with a short summary.

STOCKPILE STEWARDSHIP AND MANAGEMENT

The DOE Stockpile Stewardship and Management Program

The Assistant Secretary for Defense Programs has led the Department, its three national security laboratories, and other sites in the weapons complex, in the development of the DOE Stockpile Stewardship and Management Program. A report summarizing major features of the Program was published in May 1995, and a draft of the programmatic environmental impact statement (PEIS) for the Stockpile Stewardship and Management Program was just issued at the end of February 1996. Current capabilities and facilities, requirements, and cost efficiency combine to drive the overall architecture of the Program and to define necessary long-term investments. Additional efforts are underway to complete necessary detailed roadmaps based on requirements set forth by the Department of Defense.

The Stockpile Stewardship and Management Program calls for radical changes—many already underway—in the manner in which the weapons complex conducts business. It entails cost-cutting, making necessary investments, and adjusting to new circumstances: fewer weapons, fewer types of weapons, no production of new types of weapons, an aging stockpile, a production capability in need of modernization, and no nuclear testing. In addition to the supply of an adequate amount of tritium for weapons, the Program consists of three major elements to support a small, enduring nuclear stockpile:

- *An enhanced surveillance program to understand and predict the effects of aging.* An enhanced surveillance program does not mean simply more surveillance; it means smarter surveillance. With fewer types of weapons in the stockpile and much less capacity to work on weapons in the production complex of the future, we must become more proficient at detecting potential problems early to provide adequate time for reanalysis and action, if necessary. This calls for research and development activities in three areas:

    1. We must improve data bases on the performance of stockpiled weapons so that we can ascertain when observed behavior in aging weapons is anomalous. These activities include building a modern nonnuclear experimental data base for stockpiled weapons. Many of the nonnuclear experiments on the systems were done 10-15 years ago. Today, much better techniques are available. In addition to these new experiments, we need to make existing archival data more accessible and useful to stockpile stewards.

2. We must improve the sensors and techniques used to inspect stockpiled weapons. For example, new nondestructive evaluation techniques, such as acoustic, x-ray, and neutron tomography, can reduce the number of weapon components that must be destructively tested. Other advanced sensors are being developed—most with industrial collaboration—to enable continuous monitoring of key aging signatures within stockpiled weapons.

3. We must develop a better understanding of how aging affects the physical characteristics of a material and the resultant impact on weapon reliability and safety. Our pursuit of the "science of aging" entails activities such as molecular dynamics modeling on computers and atomic force microscopy to look at the effects of corrosion on an atomistic level. We are in the process of establishing an enhanced materials database (using surveillance and dismantlement data) and developing sophisticated computational techniques to better analyze these data.

By using the data from the enhanced surveillance program to predict component lifetimes, a more systematic refurbishment and "preventative maintenance" program—rather than an expensive and high-production-rate replacement program—will be possible. These scientific efforts are the key to an affordable manufacturing capability in the production plants (discussed below).

- *A revalidation process—backed by a set of new experimental tools—to support high-confidence assessment and certification when issues about stockpile performance occur.* The Stockpile Stewardship and Management Program includes a comprehensive assessment program to address issues that arise from the enhanced surveillance program and to evaluate the significance of observed and predicted aging processes. This program also reviews the viability of options for refurbishing or replacing specific warhead components and the viability of new production and fabrication processes and materials.

These efforts are to be tied to formal processes with the DoD for assessing stockpile weapons and modification actions. A joint DoD/DOE Dual Revalidation Program process has been developed. It was confirmed by the Nuclear Weapons Council, which directed that the W76 be the first weapon reviewed. We are currently working on establishing a Joint Certification Program with DoD to formally certify weapon performance after necessary stockpile modifications.

The quality of these revalidation activities depends on the competence of technical staff at the national security laboratories and their judgments. As the scientific underpinning of revalidation, they will have to rely on numerical simulation with advanced computer models and above-ground nonnuclear testing in more capable experimental facilities. Science-based stewardship will have replaced nuclear testing as the means to assure confidence in the reliability, safety and performance of stockpile.

Important components of the scientific backing for the revalidation program include the Accelerated Strategic Computing Initiative (ASCI), which is discussed below, and new experimental facilities to be constructed. These include the National Ignition Facility and the Contained Firing Facility at Livermore, the Dual-Axis Radiographic Hydrodynamic Facility and the Atlas Facility at Los Alamos, and the Process and Environmental Technology Laboratory at Sandia. These scientific frontier-expanding investments will both provide essential data for stockpile stewardship and maintain expertise unique to nuclear weapons in a staff that will increasingly have no nuclear test experience.

- *A small, efficient manufacturing capability to refurbish and replace aging and defective components.* The production facilities of the future must be agile and highly capable, yet affordable. With cost constraints and the planned much smaller stockpile of the future, the focus will be on capability, not capacity. Choices of production technologies will emphasize flexibility and will utilize modern commercial methods wherever possible. Clearly, there must be a much closer tie between research and development on remedies to problems that arise in the stockpile and manufacturing capabilities at the plants.

The Stockpile Stewardship and Management Program calls for integration of weapon components development with the required system engineering and associated manufacturing and materials processes. This concurrent engineering approach will reduce costs and provide flexibility to respond to potential needs rapidly. Its success depends on our ability to develop computer-based models of the performance of replacement weapon components and on our ability to simulate associated manufacturing processes so that we can study trade-off options efficiently and quickly. In support of this overall effort, the nuclear complex-wide Advanced Design and Production Technologies (ADaPT) initiative is developing techniques and technologies needed to develop new and innovative manufacturing processes that reduce cost, improve efficiency, and reduce waste production.

Several factors work to integrate the three major elements of the Stockpile Stewardship and Management Program just described. First, the laboratories and plants are developing comprehensive life-extension plans for each weapon system slated for the enduring stockpile. These plans integrate enhanced surveillance, revalidation, life-extension manufacturing activities on a weapons system by weapons system basis, and time-phase all of the activities (to the extent possible) to balance the workload. Second, each of the major elements entails substantial partnership efforts among the laboratories and between the laboratories and the production facilities. It is a shared effort requiring the special skills and capabilities and the unique facilities at each site in the complex. Finally, the Stockpile Stewardship and Management Program is only as strong as its weakest link. The effort devoted to each of the three major elements must be appropriately balanced. To increase planned funding at one site—or in one program element—at the expense of necessary activity at another will damage the overall Program.

The LLNL partnership role in Stockpile Stewardship and Management

LLNL has worked closely with Defense Programs to develop the DOE Stockpile Stewardship and Management Program, and we are highly supportive of this effort to create the necessary scientific and technical basis for stewardship in an era of no nuclear testing. We are an active partner in the Program because of the stockpile responsibilities we have, and because of our special skills and capabilities and the unique user facilities that exist at Livermore. Our partnership efforts in Stockpile Stewardship and Management include many cooperative activities with the other DOE national security laboratories, with the Nevada Test Site, with the production facilities in the weapons complex, with the Department of Defense, and with various American high-technology industries (most notably computations, lasers, high-speed instrumentation, and high-precision optics). Examples in each of the three major elements of the Program follow:

Enhanced Stockpile Surveillance. A critical issue in enhanced surveillance is the development of a better understanding of how aging affects the physical characteristics of a material and how these changes impact weapon reliability and safety. With a better understanding of aging, our enhanced surveillance program can be more predictive, which would enable systematic refurbishment and "preventative maintenance" activities—rather than expensive and high-production-rate replacement activities when aging effects have a severe impact on weapon performance.

There are many different types of materials in weapons whose aging effects must be better understood. Some are organic compounds, such as high explosives, which can be expected to degrade over time. By comparison, plutonium is a much more stable material in weapons; however, its properties are among the most complex of all the elements. In addition, if remanufacture of plutonium parts is required, long lead times will be necessary because of the limited capacity the system will have. To understand the performance of an imploding pit of a stockpiled weapon, we need to know much more about aged plutonium—its microstructure and its equation of state at relevant temperatures and pressures.

We are conducting a variety of experiments to obtain better data on the properties of plutonium. Some of these activities, such as our diamond anvil experiments, can be pursued in the laboratory with minute quantities of plutonium under highly controlled conditions, and we are working at facilities at Brookhaven National Laboratory to field such experiments. Other activities need to be conducted at the Nevada Test Site (NTS). We are working in partnership with NTS and Los Alamos to execute a series of subcritical experiments to study the properties of plutonium shocked and accelerated by high explosives. The first experiments are scheduled for later this year.

In these experiments, we will study a number of important properties of plutonium and generate data that can be used in our computational models. Sophisticated diagnostics, including the use of laser holography, will allow us to gather information about the plutonium equation of state at conditions similar to those during weapon implosion. We will also measure properties of the ejecta that comes off an accelerated plate of plutonium as a function of surface finish and other important properties. This will help us understand and better model the phenomena of mixing, which affects the performance of primaries in stockpiled weapons.

A Science-Based Revalidation Process. Decisions about the stockpile must be grounded in experimental reality and simulations using detailed, calibrated computer models. At Livermore we operate state-of-the-art experimental facilities for the integrated complex, including the High Explosives Applications Facility (HEAF), the Flash X-Ray facility at Site 300, and the Nova laser system. This past year, for example, weapon scientists from Livermore and Los Alamos conducted more than 200 experiments with the Nova laser to study hydrodynamic instabilities and mixing, material opacity, equations of state, and other aspects of weapon physics. These experiments generated important information about the physical processes occurring in nuclear weapons, and their results provided essential feedback and information for our physics computer codes.

A critically important thrust in the science-based revalidation process is improvement of the computer models we use. Numerical simulation and computer models, benchmarked with historical nuclear test data and results from laboratory experiments, will be the principal tools for assuring stockpile performance in the future. In the absence of nuclear testing, we need more realism in the computer simulations—improved models of physical effects, greater resolution, and use of three spatial dimensions to model unsymmetrical physical phenomena (such as those produced by aging effects). This calls for a 10,000- to a 1,000,000-fold increase in computer speed and data storage capacity.

The objective of the Accelerated Strategic Computing Initiative (ASCI), a central element in the Stockpile Stewardship and Management Program, is to vastly improve the high-performance computing capability at the national security laboratories. ASCI is a research partnership in which the laboratories have begun to work with industrial firms to develop technologies—including software, data storage, and communications environments—that address the specific problems of the highest-end weapons physics models. Multiple vendors may participate in various partnerships, yet each partnership will proceed in a way that ensures portability of major weapons codes between platforms.

The proposed ASCI budget in FY 1997 is $122 million, a sizable fraction of which is intended for procurement of prototype high-end supercomputers from American industry. We will be buying—and working with our industrial partners to debug, refine, and improve—computational capabilities which should reach the commercial marketplace ten years hence.

Our research partnerships with the computer industry will build on the "business plans" of the vendors. The building blocks of our supercomputers will be "off-the-shelf" processors. These "commodity" parts range from single-processor building blocks to shared-memory systems with 8 to 100+ processors. ASCI is not intended to drive processor development. That is a $100 billion industry. Rather, ASCI intends to build on the "business plans" of the vendors—how they intend to cluster the commodity building blocks into systems with ever-increasing capability. These partnerships will expedite the process. We will obtain computing capabilities that we need for stockpile stewardship and management. Industry will obtain for their prototype computer systems sophisticated customers who can help refine concepts and develop necessary software.

One approach to more powerful supercomputing follows the path of the current state-of-the-art supercomputers at the national laboratories—single massively parallel processing (MPP) machines, with large numbers of individual nodes each with its own memory, tightly coupled via a custom, high-speed network. Some software applications work exceedingly well in an

MPP architecture; others present difficulties which are yet to be overcome even on small scale machines. Complementary approaches to more powerful supercomputing use as a building block shared-memory processors (SMPs). Here, the challenge for ASCI is the seamless integration of a large number of these SMP machines to create the capabilities we need. As the individual SMPs represent the high-volume segment of the commercial market, this general approach will benefit from a much richer software environment.

We have already initiated one research partnership to provide a "TeraFLOPS" supercomputer by end of calendar 1996. A "TeraFLOPS" supercomputer performs a trillion floating-point operations per second, which, operating at even a modest 10% efficiency, represents a 1,000- to 10,000-fold improvement over the capability of our best current supercomputer. This will allow us to perform some 3D hydrodynamics calculations coupled with radiation transport, which is an important but modest program milestone. We are in the process of soliciting two additional research partnerships, each to provide a "several-TeraFLOPS" supercomputer by the middle of 1998. Our fourth partnership is envisioned as a "10-TeraFLOPS" capability in the year 2000.

The three laboratory sites will each provide both open and secure "TeraFLOPS" capability. It is anticipated that the primary secure usage will be local. However, the research nature of the ASCI partnerships requires seamless remote access for some fraction of the ASCI applications development teams. Open, remote access is also necessary to foster effective working partnerships with research universities and other centers of excellence for high-performance computing.

Our strategy of pursuing multiple approaches and creating multiple industrial research partnerships is aimed at accelerating existing performance trends to meet our specific needs. It is not possible to predict which technology path will lead to the best results; indeed, it is unlikely that a single technical approach will serve all program requirements. Therefore, the research partnerships must overlap both in time and in technical approach in order to achieve high payoff with manageable risk, ensure flexibility, avoid dependence on single vendors, and serve diverse program needs.

An Agile Manufacturing Capability. LLNL is developing technologies to provide cost-effective manufacturing capabilities to replace aging weapon components or refurbish them to extend their life. This is an urgent need. In the near-term we must be capable of replacing any questionable components to important weapon systems—even as the production capability is being restructured to be consistent with future stockpile needs. Some of our manufacturing and refurbishment efforts entail making effective use of industrial partnerships to pursue technologies in precision fabrication and non-destructive evaluation. These activities, which are part of the nuclear weapons complex-wide Advanced Design and Production Technologies (ADaPT) initiative, are designed to provide cost-effective technologies for use in ongoing refurbishment activities at the earliest possible date.

We have ongoing activities to extend the life of the W87. The objective is to enhance the structural integrity of the W87 so that it may remain part of the enduring stockpile beyond the year 2025 and will meet anticipated future requirements for the system. The W87 warhead/Mk21 reentry vehicle (RV) is the leading candidate for a single RV option for the Minuteman III ICBM. It is the most modern and safe US nuclear warhead. It incorporates all "Drell safety" features: Insensitive High Explosive, a Fire Resistant Pit, and an Enhanced Nuclear Detonation Safety.

The W87 Life Extension Program (LEP) exercises many aspects of the nuclear weapons complex and provides a model of how stockpile stewardship and management must work. Livermore has worked closely with the Air Force, the DOE production agencies and plants, and the other weapons laboratories to ensure that the warhead alterations can be carried through at the plants and will meet the requirements of the customer.

Interactions with the DoD include a detailed examination of the current operating environment of the W87/Mk21, as well as a projection into the future of how that environment may change. W87 LEP activities include flight testing, ground testing, and physics and engineering analysis. We work with Air Force Space Command and defense contractors to interpret and apply the data obtained. These activities are being coordinated by a Joint DoD/DOE Working Group under the direction of the Nuclear Weapons Council.

W87 LEP warhead refurbishment activities involve the Pantex Plant, Allied Signal in Kansas City, and the Y12 Plant in Oak Ridge. We involved the plants early in the LEP so that an option is developed that meets performance requirements and can be produced efficiently with high quality. Operations at the Y12 Plant have provided the greatest challenge for the W87 LEP because of the suspension of many operations at that facility. As a work-around, Livermore has been building the mock W87 hardware required for the development phase of the LEP.

In consultation with Y12 engineers and facility managers, we are developing refurbishment processes and equipment to be used for full scale production. Our emphasis is on the use of modular workstations and new technologies to reduce waste, floor space, and necessary equipment. An example is the use of laser technology developed at LLNL to cut certain high-value parts. The importance of this technology is that the amount of material removed in the laser-cutting process is extremely small, with almost no damage to the remaining material. The process not only preserves the existing part, but it essentially eliminates the waste stream created in the traditional remanufacturing process.

A demonstration project is underway to show the feasibility of using lasers to cut high-value parts in the W87. The project utilizes capabilities developed in the Inertial Confinement Fusion program and in the Atomic Vapor Laser Isotope Separation program along with technologies that have been developed over the last several years in Cooperative Research and Development Agreements with various industrial partners. The demonstration will be conducted in an environmentally controlled workstation designed and built at Livermore in a cooperative effort with Y12 personnel. If the demonstration is successful, the technology can be transferred to the production environment. While this technology will be specifically developed for the W87 LEP, it has general applicability to several stockpile systems and could be applied to future refurbishment programs.

Finally, we must determine whether the alterations could have any appreciable effect on nuclear yield and certify the performance of the refurbished weapon. We are using archival information, data gathered in new experiments (including some using the Nova laser), and a combination of established computer simulation techniques and new ones. Los Alamos has been an active observer at all phases of the W87 LEP, and formal peer review has taken place in the conceptual phase and the final development phase of the program. As we move into final testing and evaluation, further in-depth review will be requested before LLNL certifies the final refurbishment option.

Special LLNL responsibilities in Stockpile Stewardship and Management

Stockpile Responsibilities. Livermore shoulders special responsibilities in the Stockpile Stewardship and Management Program because we are the design laboratory for weapon systems in the enduring stockpile and for weapons to be retired. For the latter, we have a continuing active responsibility to ensure safe and timely dismantlement and disposition of excess materials. Dismantlement of the W68 SLBM warheads and the W71 ABM warheads has been completed, and work is essentially completed on the W70 Lance warheads. Weapon systems that are currently being dismantled or are to begin to be dismantled soon include the W48 and W79 artillery projectiles, the W55 SUBROC, and the W56 ICBM warheads.

Livermore's responsibilities for the enduring stockpile include the B83 bomb, the W84 cruise missile warhead, and the W87 ICBM warhead. These are the only systems in the inventory with all the modern safety features, and they are expected to endure past their originally anticipated lifetimes. In addition, Livermore is responsible for the W62 ICBM warhead, which is to remain in the active inventory past the end of the decade. We are developing comprehensive plans to extend the life of these systems, and significant effort currently is being expended on their surveillance, maintenance, and selective refurbishment. Our efforts in the W87 Life Extension Program have previously been described.

Special User Facilities at LLNL. Livermore has additional responsibilities in the Program because of our special skills and capabilities and the unique user facilities that exist at Livermore. In addition to a number of important but smaller science and engineering facilities, these include:

- *the High Explosives Applications Facility (HEAF),* which is the most modern facility for high explosives research in the world;
- *the Nova laser facility,* which—until construction of the National Ignition Facility—remains the premiere facility in the world for conducting high-energy density physics experiments essential to evaluation of important nuclear weapons issues;
- *the Flash X-Ray facility at Site 300,* which is currently the most capable hydrodynamic test facility in the world;
- *the Secure and Open Computing Facilities at LLNL,* which meet our core program needs for stockpile stewardship and serve as a testbed for development of high-performance computing hardware and software;
- *the AVLIS facility and program,* with the most advanced capabilities in the world for conducting research and development on industrial-scale processes involving uranium; and
- *the Superblock,* small, but modern facilities for special nuclear materials research and engineering testing.

Livermore also has the lead in the development of two major user facilities that figure prominently in the Program: the National Ignition Facility and the Contained Firing Facility at Livermore's Site 300.

The National Ignition Facility. The National Ignition Facility (NIF) was identified by the Assistant Secretary of Energy for Defense Programs, Victor Reis, as being "the most important new facility" in the Defense Programs budget request last year. The NIF is a cornerstone of the Stockpile Stewardship and Management Program. It is the only facility that will permit well-diagnosed experiments pertinent to fusion and high-energy-density physics processes which occur after the high explosive is detonated. The NIF is also the critical next step in the development of Inertial Confinement Fusion (ICF) as an environmentally attractive energy source, and it will serve as a user facility for a wide range of fundamental scientific research. Initial operational capability is planned for late 2002. To keep to this effort on schedule and on budget, DOE Defense Programs has requested $191 million for the NIF project in FY 1997.

This FY 1997 budget request has two components: a $132 million line item for NIF construction and $59 million as a portion of the roughly $240 million FY 1997 national ICF base program. I urge full funding for both the NIF and the national ICF base program. These highly interrelated efforts have recently been favorably reviewed by the Inertial Confinement Fusion Advisory Committee and the JASONs. The JASON report concluded: "we are convinced that the present ICF program *does* make an important contribution to science-based stockpile stewardship, and that the NIF will *substantially* increase this contribution."

The NIF will consist of the laser system and optical components, a target chamber, and computer control system all in an environmentally controlled building. The laser, consisting of 192 beams to deliver 1.8 million joules and "ignite" small fusion targets, will be the world's largest optical instrument. Its construction will allow America to retain world leadership in ICF. It will advance US high technology industries such as those in optics, lasers, materials, high-speed instrumentation, semiconductors, and precision manufacturing. The DOE has estimated that at the peak of activities the project will create about 3,000 construction and manufacturing jobs nationwide.

Following completion of the Conceptual Design Report in April 1994, Secretary O'Leary announced her approval of Key Decision 1 for the NIF in October 1994, which allowed the next phase of NIF design to begin. At that time, the Secretary established a formal process to evaluate the consistency of the facility with US arms control and nonproliferation objectives. The completed study, which went through interagency review, concluded that the "technical proliferation concerns of the NIF are manageable and therefore can be made acceptable" and that "the NIF can contribute positively to US arms control and nonproliferation policy goals."

Substantial progress has been made on the NIF project this past year. We have completed an updated Quality Assurance Plan, the Project Execution

Plan, the Title I Plan, and Advanced Conceptual Design. Selection has been made of the NIF project architect and engineering contractor. In addition, together with Los Alamos, Sandia, and University of Rochester's Laboratory for Laser Energetics, we began the next phase of design work (Title I) for the NIF.

We also continued our experiments using the Beamlet laser, which is a full-scale prototype of a NIF beam. This work is providing us high confidence in NIF performance, schedule, and cost goals. We have demonstrated NIF laser performance on a per-unit-area basis, and we are now testing the target illumination capability of the system.

The NIF will attract talented scientists and engineers to contribute to stockpile stewardship because multiple benefits will derive from a vigorous ICF program in the coming decades. As a user facility, the NIF will support research on:

- National Security. The NIF will provide access to high-energy density physics regimes essential to evaluation of important nuclear weapons issues. Scientists will be able to obtain nuclear-weapon-related physics data, particularly in the area of fusion and the high-energy-density physics which occurs after the high explosive is detonated for comparison with advanced numerical simulations. These include high-quality opacity data for partially ionized materials, valuable information about the mixing of layers of different materials during implosion, and data that can help us assess the impact of cracks and other abnormalities on weapon performance. Other experiments will be able to provide valuable data on nuclear weapons effects issues. Moreover, the NIF will help us evaluate issues for existing designs and improve and test computational models, but it will not enable us to design new weapons *per se*.

- Fusion Energy. The NIF is an essential element in the program for the development of inertial fusion energy for civilian power production. If net fusion energy gain is demonstrated, as anticipated, the NIF will constitute a crucial step towards the ultimate goal of providing energy security for the US in the 21st century. The role of the NIF and ICF as the principle alternate to the Tokamak was acknowledged by the recent Fusion Energy Advisory Committee report.

- Science and Technology. The NIF will produce conditions in matter similar to those found at the center of the sun and other stars. New, well-characterized, high-energy-density regimes will be routinely accessible in the laboratory for the first time. The NIF will advance scientific and technical fields such as astrophysical sciences, plasma physics, atomic and

> radiative physics, hydrodynamics, materials science, advanced coherent and incoherent x-ray sources, nonlinear optics, and computational physics. Scientific progress in those fields will, in turn, provide enhanced understanding of the physical conditions in nuclear weapons.

The need for the NIF is independent of any siting decisions. However, Secretary O'Leary has voiced her preference for Livermore. LLNL is the natural siting choice because of the large contribution we have made to the advancement of ICF, our development of the new laser system to be part of the NIF, and the fact that LLNL has over 4000 staff-years of experience in ICF and related science and technology. The facility would greatly benefit from and contribute to LLNL's existing unique capabilities in lasers, and the NIF would play a key role in the future evolution of Livermore.

The Contained Firing Facility at Site 300. Hydrodynamic testing is the only currently available way of experimentally testing the high-explosives-initiated implosion phase of a nuclear detonation. These are critical experiments for understanding weapon safety, assessing the performance of weapon primaries, and evaluating the feasibility of approaches for safely disabling a nuclear device. The Stockpile Stewardship and Management Program includes funding for construction of the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) at LANL and for upgrade of the Flash X-Ray facility (FXR) at LLNL's Site 300 to make it a Contained Firing Facility. Containment of the FXR test bed and the debris from explosive experiments will enhance this important national capability and permit its continued use even if there are future, more stringent environmental restrictions. Investment in the Contained Firing Facility ensures our ability to continue critically important hydrodynamic experimentation into the 21st century.

The FXR is the best diagnostic tool currently available for measuring integrated performance of nuclear weapon primaries by nonnuclear testing. We continue to improve its capability. Last year a major upgrade was completed to increase the power of the electron beam produced by the linear accelerator at the facility. During a hydrodynamic experiment a tantalum target converts the electron beam into an intense X-ray beam, which is used to take an X-ray picture of the test object. The upgrade permits us to obtain a higher resolution X-ray photograph of an imploding mock primary and to take the picture even later during in the implosion process when the material is extremely dense. Our next planned upgrade, which has just begun and is due to be completed in about two years, allows scientists to take two pictures during an experiment and directly determine the velocity of the imploding materials.

STEMMING THE PROLIFERATION OF NUCLEAR WEAPONS AND OTHER WEAPONS OF MASS DESTRUCTION

Proliferation dangers and responsive activities at LLNL

Stemming proliferation of weapons of mass destruction (WMD) is a critical priority for the United States. It is a major challenge that requires a multifaceted effort by the US Government with activities and programs coordinated among the various agencies that shoulder nonproliferation responsibilities. The DOE laboratories are working closely together to support DOE's nonproliferation objectives, which are to control nuclear materials and expertise, reduce nuclear weapons worldwide, roll back proliferant development programs, prevent acquisition of nuclear weapons, avoid surprise, and respond to proliferation emergencies.

Nation-states or rogue subnational units, such as terrorists, might acquire nuclear capability through the theft and subsequent sale of fissile materials or weapons. Alternatively, proliferation can occur through indigenous development programs that draw on the increasing availability of nuclear technology and the continuing spread of nuclear expertise. Livermore's arms control and nonproliferation activities respond to both of these troubling proliferation scenarios. Our efforts are concentrated in three areas:

- *Controlling nuclear material at its source and stemming the spread of nuclear know-how.* Since the break up of the Soviet Union, this has been a major thrust area for the DOE national laboratories. Our principal activities relate to control of fissile material throughout the Newly Independent States (NIS), support of Russian efforts in weapons dismantlement and materials disposition, and cooperative threat reduction in the NIS through defense conversion activities at their nuclear laboratories.

- *Countering nuclear smuggling and nuclear explosive terrorism.* In spite of best efforts at control, some nuclear material might get into the wrong hands. And events this past year in Oklahoma City, Tokyo, London, and Tel Aviv soberly warn us of the danger posed by the possibility of nuclear terrorism. The threat of WMD terrorism has become a high priority national concern. Livermore is taking the lead in aspects of countering nuclear smuggling and nuclear terrorism through new initiatives which I will describe. These efforts should be strengthened, and they could be widened to counter chemical and biological threats through application of many similar detection and analysis techniques.

- *Detecting and reversing nuclear weapons activities by nation-states.* These activities include long-standing Livermore programs in intelligence analysis, in sensor development for detecting and monitoring WMD activities, and in support of treaty negotiation and implementation.

The progress the DOE laboratories has made in these three areas is substantial, and some of Livermore's specific accomplishments are discussed below. We have made a good start at dealing with post-Cold War nuclear threats to US interests. However, the technical and policy challenges posed by these threats are considerable and much more needs to be done. For many of our activities, progress is constrained by funding and important milestones could be achieved earlier if additional resources were available.

Controlling nuclear materials and stemming the spread of nuclear know-how

Since the breakup of the Soviet Union, controlling nuclear materials and expertise has been a major thrust area for the DOE national laboratories. Our principal activities are:

Control of Fissile Material throughout the NIS. Livermore contributes to the Los Alamos-led multi-laboratory DOE program to improve nuclear material protection, control, and accountability (MPC&A) at Russian facilities. As part of this effort, LLNL has the lead in assessing the vulnerability of storage facilities and providing measurement systems for fissile material to Russian institutes so that they can establish and verify nuclear material inventories.

In addition, our interactions in other Newly Independent States helped identify the existence of hundreds of kilograms of highly enriched uranium in Kazakhstan, which were subsequently withdrawn to the US in the highly successful Project Sapphire led by Oak Ridge National Laboratory in 1994. Afterwards, we led a multilaboratory team that developed a program to provide technical assistance to Kazakhstan.

Russian Warhead Dismantlement and Materials Disposition. LLNL has a lead technical role in the negotiations for Mutual Reciprocal Inspections of fissile material removed from dismantled nuclear weapons. This is an initiative with Russia to gain confidence in the process of nuclear warhead dismantlement. We participate in the DOE Transparency Working Group, which develops white papers for the Interagency suggesting US positions on various possible monitoring arrangements. LLNL is now chairing an effort to evaluate warhead radiation signatures for tracking warheads through the dismantlement process. We have had exchange meetings on these issues with the Russians, which have included technical demonstrations at Livermore's plutonium facility.

In addition, LLNL continues its lead-laboratory role in the development and implementation of transparency measures associated with the purchase of highly-enriched uranium from Russia. We have provided technical guidance on monitoring visits and familiarization visits to technical facilities in Russia and at the two transparency review committee meetings.

Finally, the DOE is evaluating alternative means for disposition of excess fissile materials. Livermore is responsible for assessment of two of the options (geological disposition in a deep borehole and immobilization in either glass or ceramics) and for technical work on the immobilization option. The US has recently engaged the Russians in parallel studies. This issue is expected to be addressed at the summit meeting on nuclear safety to be held in Moscow in the spring of 1996. Recently, we hosted a meeting of the US and Russian delegations in which proposals were developed for joint experimentation to advance disposition technology in both countries.

Commercial development activities at NIS weapons institutes. Livermore is heavily involved in international nonproliferation efforts aimed at engaging those with nuclear know-how in the NIS in commercially viable work with non-weapons and civilian applications. LLNL is a principal participant in the Industrial Partnering Program, which pursues defense conversion of former nuclear weapons institutes in the NIS through partnerships with DOE laboratories and American industry in projects that have commercial potential. Livermore is involved in over 20 projects— many initiated last year—that employ over 400 NIS weapons scientists.

Countering nuclear smuggling and nuclear-explosive terrorism

To protect against failure to control nuclear material at its source, we are pursuing new initiatives to counter nuclear smuggling and nuclear-explosive terrorism.

Countering Nuclear Smuggling. As part of a priority US effort to combat the threat of nuclear smuggling, DOE was made the lead agency for technical analysis of nuclear trafficking incidents and for MPC&A cooperation (described earlier). LLNL is leading two important efforts to counter nuclear smuggling:

- *Support to law enforcement and other agencies in assessing illicit nuclear trafficking cases and in training US and foreign officials.* DOE's assessment capability for illicit nuclear trafficking, centered at Livermore, is a unique national and international resource in dealing with actual or alleged cases of nuclear smuggling. Closely affiliated with our long-standing nuclear threat credibility assessment capability, this program draws on all-source databases (including details on incidents dating back to 1966) and experienced analysts to provide on-call support to law enforcement and other officials in the US and abroad. In 1995 we provided technical assessments to law enforcement agencies in many separate cases involving the attempted illegal sale of alleged nuclear materials; and, related to counter-nuclear terrorism, we direct and participate in the credibility assessment of nuclear extortion threats targeting the US.

We also train foreign police and customs officials to be more effective in detecting and investigating nuclear trafficking. We provided instruction at the International Law Enforcement Academy in Budapest, at other international customs seminars and conferences, and in various bilateral settings. We have also designed and tested a nuclear material identification kit that can be used by inspectors at checkpoints or suspected sites for detecting nuclear smuggling. Early versions are now available to US government agencies.

- *Forensic analysis of seized materials to gain information about their origin and route.* A few extremely significant nuclear smuggling cases have involved the seizure of kilogram quantities of genuine, weapons-usable nuclear materials. In such cases, it is vitally important to learn as much as we can about the stolen materials and their origin, so that officials can shore up security deficiencies, determine whether additional material is at large, and prosecute the criminals involved. Detailed forensic analysis of confiscated materials and associated packaging can play an important role, and in 1995 LLNL led a multilaboratory DOE effort to select and apply relevant techniques to this problem. Because most seizures have occurred abroad, international cooperation is indispensable.

In November 1995, LLNL hosted the highly successful *International Conference on Nuclear Smuggling Forensic Analysis*, which brought together a mix of technical, intelligence, and law enforcement experts from 14 countries to compare experiences and techniques. Notable was the participation by the Russian Federation, which can play a pivotal role in helping to determine sources of smuggled nuclear material.

The Conference paved the way for ongoing technical cooperation through the creation of an International Technical Working Group (ITWG) and an agreement to conduct international exercises. At the first meeting of the ITWG earlier this year, plans were developed for an international interlaboratory exercise, which will include the analysis of the highly-enriched uranium seized in an actual nuclear smuggling case in 1994. A follow-on meeting of the ITWG is planned for this summer in Moscow.

A more comprehensive effort in counter-nuclear smuggling will require a strategically-planned multilaboratory/multiagency program. Within DOE, a Focus Group is working to coordinate DOE's anti-smuggling activities and to identify gaps where new or expanded work is needed. Proposals are being developed for additional investments in this important area.

Countering Nuclear Explosive Terrorism. Countering the covert delivery of nuclear devices against the US is closely related to countering the smuggling of nuclear materials since many similar detection and analysis methods can be used. Our approach is to build on our extensive experience with DOE's Nuclear Emergency Search Team (NEST), the Threat Credibility Assessment Center, the Accident Response Group, the Radiological Assistance Program, and the Federal Radiological Management Assessment Center. Our new efforts include evaluating the risk, developing improved techniques for detection and disablement, and devising new investment strategies for dealing with nuclear terrorism:

- *Evaluating the risk of stockpile theft.* Using new research in human reliability and new security simulation codes, we recently completed an assessment of the risks associated with the theft of a nuclear weapon from the US stockpile by a terrorist group and the subsequent use of that weapon against this country. Our findings will improve our understanding of security needs for nuclear weapons storage worldwide.

- *Developing a new concept for fissile-material detection—Wide Area Tracking System (WATS).* WATS is a concept for detecting covertly-delivered nuclear devices with a system that can be deployed rapidly to detect the movement of nuclear materials. The WATS project is expected to transition into a formal DoD/DOE Advanced Concept Technology Demonstration (ACTD) in FY 1997. During the first year of the two-year ACTD effort, we will work with the military to determine operational requirements and complete the hardware design/integration.

- *Developing new techniques for the disablement of improvised nuclear devices (INDs).* We are striving to develop high-confidence techniques that can be used to disable, without producing any nuclear yield, a large spectrum of possible INDs which might be encountered in a nuclear terrorist incident. Results to date have been very positive. However, at the current level of funding, development and proof testing of our next field deployable technique is several years away. Funding limitations have also necessitated placing on hold the pursuit of other promising advanced disablement concepts.

- *Initiating a comprehensive study.* We are initiating a comprehensive study to better understand US needs and appropriate technological and systems solutions to counter nuclear (and other WMD) terrorist threats. Our goal is to determine how the national laboratories and other agencies can best leverage their resources, so that the most important and most tractable problems receive the greatest effort.

Detecting and reversing nuclear weapons activities by nation-states

Our more traditional activities in monitoring and rolling back nuclear weapons programs of proliferants include long-standing Livermore programs in intelligence analysis, sensor development, and support of treaty negotiation and implementation. We also provide support to counterproliferation efforts, which are funded by DoD.

Intelligence Analysis and Policy Support. Livermore has been supporting the US intelligence community for 30 years by tracking and analyzing the nuclear developments in countries of importance to US nonproliferation goals. Our technical support assists US policy makers in taking actions to encourage the exclusively peaceful use of nuclear technology and to discourage the proliferation of nuclear weapons. In addition, we have completed numerous studies of the paths to nuclear weapons production being taken by several proliferant countries. These analyses are used by many government agencies that deal with proliferation issues as they evaluate possible response options and develop policy strategies to reduce regional tensions and motivations for WMD proliferation.

We also have supported the US government in negotiations with countries such as India, Kazakhstan, North Korea, Russia, South Africa, and Ukraine. In addition, we evaluate for DOE an average of five to ten export requests a week concerning prospective illegal or inappropriate exports of information or commodities. We make certain that US exports are in compliance with federal law and international nonproliferation commitments.

Sensor Development for Detecting and Monitoring WMD Activities. Nonproliferation sensor research and development constitutes our largest program effort for DOE's Office of Nonproliferation and National Security. This work, coordinated with that of other DOE labs and government agencies, focuses on the development of unique instrumentation and techniques for use by the US military, intelligence, and arms control communities. LLNL-developed sensors are used in international operations for treaty-compliance monitoring and mutual confidence building. In addition, Livermore has provided specialized monitoring equipment to the United Nations for the long-term monitoring program in Iraq.

The challenge in developing sensors to detect proliferation activities is to create instruments which are both highly sensitive and highly selective for detecting weak signal in difficult environments. Our accomplishments span a range of sensor technologies, from remote sensors to portable hand-ons and unattended instruments, for various applications:

- *Sensors for remote optical characterization of proliferation activities.* Many industrial processes generate and release tell-tale chemical signatures which can provide information about the activities taking place within a facility. The ability to remotely interrogate the chemicals released into the environment from a facility would provide a powerful means for monitoring treaty compliance or detecting weapons production activities. Our efforts include fielding systems that—over time—incorporate progressively more advanced technology to accomplish this challenging objective.

  Livermore is also involved in the development of imaging sensors to provide both spatial and spectral information about suspect facilities. Airborne tests of the Compact Airborne Multispectral Imager held during 1995 and early 1996 demonstrated the use of this DOE/LLNL-developed technology for aerial reconnaissance. LLNL has led the development of a new, more sensitive infrared spectrometer for airborne remote sensing of trace chemicals in the atmosphere. It will be flown aboard a US Navy aircraft in 1996 as part of the DOE Airborne Multisensor Pod System.

  We are a major participant in an advanced-technology multi-laboratory program to develop laser-based systems for detecting trace chemicals in the atmosphere, particularly those that might indicate activities associated with nuclear weapons production. LLNL is responsible for the development and engineering of systems that utilize state-of-the-art solid-state laser hardware and for characterizing chemical signatures. We operate the facility used for hardware testing at the Nevada Test Site.

- *Laboratory and field-portable instrumentation for chemical analysis.* Livermore scientists have developed a prototype advanced, portable mass spectrometer that is light-weight, battery-operated, and capable of detecting chemicals in the environment at very low levels. It is for use in the field by arms control inspectors during cooperative, on-site visits and would provide real-time feedback at the facility to help identify locations for further sampling, analysis, and investigation. In recognition of the significant technological advances that went into this design, Livermore scientists were presented an R&D 100 award in 1995 by *R&D* Magazine.

Livermore is also home to a state-of-the-art analytical laboratory, the Forensic Science Center, whose specialized staff bring a wide range of advanced chemical analysis techniques to bear on special samples for the US Government and law enforcement communities. The Forensic Science Center is a unique resource for analytical instrumentation and methods tailored to the needs of the proliferation detection community.

- *Unattended ground sensors.* Our unattended ground sensors program draws on microtechnologies to achieve small size and low power consumption. We have developed and deployed networked sensor systems for treaty monitoring. These sensor technologies have also been used for environmental characterization, counter-narcotics, civilian law enforcement, and immigration and border control.

Treaty and Arms Control Support. Our treaty and arms control work principally focuses on support to the International Atomic Energy Agency (IAEA) and issues about monitoring a Comprehensive Test Ban Treaty (CTBT). We are also supporting activities related to the START treaties, a Fissile Material Cutoff Treaty, the Chemical Weapons Convention, and regional security issues.

- *Support to the IAEA.* LLNL has been helping the IAEA meet its new technical challenges following the post-Gulf War revelation of Iraq's extensive nuclear weapons program. We have supplied inspectors and developed and fielded equipment in support of inspections in Iraq; we have worked with IAEA to bolster the Agency's ability to enforce safeguards; and we are providing technical assistance to selected foreign laboratories on peaceful uses of nuclear technologies.

- *CTBT Monitoring.* The CTBT effort at LLNL is focused on completing the research and development necessary to permit effective monitoring of the Treaty. Livermore is working closely with the other national laboratories to deliver software systems this year that can accurately locate and identify events with explosion characteristics in regions of interest. We also have provided input to DOE on the impact of a CTBT on the maintenance of the US nuclear stockpile. These studies have allowed DOE to develop negotiating positions for Interagency consideration prior to and during the CTBT negotiation. In addition, our scientists have provided expertise to the Conference on Disarmament, the international Group of Scientific Experts on seismic detection, and the On-Site-Inspection Working Group.

INSTITUTIONAL AND MANAGEMENT ISSUES

Improving the way LLNL does business

On September 25, 1995, as the President directed DOE to carry out the necessary programmatic activities to ensure stockpile performance, he also stated that:

> "...these labs must be run as efficiently as possible. I have directed the agencies to review and, as appropriate, to rescind internal management instructions and oversight that impede laboratory performance. I have directed the agencies to clarify and focus the mission assignments of their laboratories. I also have directed the agencies to achieve all possible budget savings through streamlining and management improvements before productive R&D programs are sacrificed."

It is important that we succeed in these efforts. Livermore has been working with the DOE on management and oversight issues through Department-wide efforts and various pilot projects aimed at streamlining excessive DOE rules and regulations and consolidating laboratory audits and reviews. In addition, we have stepped up our long-continuing efforts to improve the efficiency and effectiveness of LLNL operations and cut costs.

At Livermore we have made major progress on a broad range of initiatives to achieve cost reductions and greater efficiency in meeting our mission objectives. Some highlights include:

- We have managed to downsize the workforce at the Laboratory by over 2000 people or approximately 20% over the past half dozen years without significantly disrupting operations.

- We have restructured major parts of our organization to clarify and strengthen lines of responsibility and accountability.

- We are just completing a top-to-bottom cost cutting review which is providing an objective basis for further workforce restructuring and economization.

- We are reducing overhead and out-sourcing more of the routine services required to support our activities.

- We have greatly streamlined our procurement practices and reduced the size of our business operations organization by 38% as well as reduced the cost by 30% since FY 1994.

These actions and others currently being planned will improve our cost effectiveness without sacrificing our ability to meet programmatic milestones.

University of California management of the work performed by LLNL

A second important aspect of Livermore's administration and operations is the role of the University of California (UC) in overseeing our work (and that performed by the Los Alamos and Berkeley laboratories). The current management and operating contract between UC and DOE added a much stronger management role for the University, and it also introduced performance measures as a way of evaluating the activities of the laboratories. On balance the new contract has been quite successful. It pioneered the whole concept of performance-based management within DOE, and in many ways this contract has paved the way for other recent contractual actions taken by DOE.

An exceedingly important part of this management role is the University of California's President's Council on the National Laboratories, which oversees all the scientific and technical work performed at the three National Laboratories UC manages. In particular, the National Security Panel of the President's Council is providing outstanding service to the nation. The Panel has a very strong influence on the national security activities at the laboratories through its effective reviews of our programs. Its constructive criticism of our scientific work, its probing questions, and its recommendations how the laboratories can better integrate their efforts have had a major impact on the design of the Stockpile Stewardship and Management Program.

The University of California has been the contractor operating Livermore—as well as Los Alamos and Berkeley—since our beginning. This arrangement has provided great benefit to LLNL and the nation. It has been a major factor in attracting and maintaining the quality of our workforce, it has provided an atmosphere in which independent views and technical honesty are treated as core values, and it has led to an array of scientific and technical associations that would have otherwise not been achievable. These are exceedingly important factors to preserve as we face new technical challenges in stockpile stewardship and management and in stemming proliferation.

SUMMARY REMARKS

The DOE Stockpile Stewardship and Management Program lays out a challenging program for the national security laboratories and other elements of the nuclear weapons complex. It represents a major change from the design and testing of weapons to a program in which enhanced surveillance of the stockpile, nonnuclear experiments, and computations form the basis of judgments about the safety and reliability of weapons. It calls for the creation of a manufacturing capability that depends on strong partnerships among the laboratories, modernized production facilities, and American industry.

The Stockpile Stewardship and Management Program is a demanding effort which requires a long-term commitment by outstanding scientists and engineers. It also requires long-term, new investments in capabilities and facilities for stewardship and management of the enduring stockpile—on the order of $4 billion per year for a decade. This can only happen if there is sustained bipartisan support for the Program from Congress and the Administration. Accordingly, I urge your strong support of the FY 1997 budget submission for Defense Programs. It is imperative that we lay a solid foundation early in the effort to ensure the Program's success.

Technically difficult challenges also face Livermore scientists and engineers working on projects to stem the danger of proliferation of weapons of mass destruction. Livermore plays a very prominent role in the national effort, providing expertise and technology to support arms control policy development, arms control verification, and intelligence analysis of nuclear weapons activities worldwide. We are also undertaking leadership roles to counter nuclear smuggling and nuclear terrorism, and we are heavily involved in activities to help Russia improve protection, control, and accountability of its fissile materials. Much more can and needs to be done. Consequently, I also urge your strong support of the program proposed by the Office of Nonproliferation and National Security. We should also explore mechanisms for broadened federal support from other agencies in this important area.

Mr. HUNTER. Thank you, Dr. Tarter.
Dr. Hecker.

STATEMENT OF SIEGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

Dr. HECKER. Thank you, Mr. Chairman and other members of the committee. It is a great pleasure to be here and be able to make a few comments. I have a written statement and I will just try to catch some of the highlights based on what has been said so far.

You have already said, Mr. Chairman, that we have a tough job ahead of us, and in my opinion, the science-based approach is really the only approach which is going to allow us to get there, and the science-based approach, by that I mean really getting a better fundamental understanding of what is going on in nuclear weapons. That has been evident for a number of years, as even the underground nuclear testing, when it was still allowed, as the numbers of tests went down and as we started to work in an era of no new designs, it became clear that we must get a more fundamental understanding.

Of course, it has become really crucial now because of the President's decision on the zero-yield comprehensive test ban, and so that really means that we have had to transition into a new paradigm. In that new paradigm, actually, we cannot guarantee success. However, we feel that the science-based approach is our best opportunity to get there, but it requires three things: People, facilities, and then, of course, the financial support.

What I would like to do this morning is just concentrate a bit on the people aspect of that, because, in essence, as we talked about safety and reliability, but especially safety, that in nuclear weapons, the safety is not so much just in the product. The safety is really in the people that are behind the product. The reason that that is so important for nuclear weapons and why the people are so important is because nuclear weapons are sitting there and constantly changing and they require a great deal of tender loving care or babysitting from those folks who designed them, from those people who manufactured them, and those people who have the responsibility in the end to disassemble them.

Let me just give you a sense as to why that is true. We are all aware that some of the things change quite rapidly, such as tritium, and that it decays at a rate of 5½ percent a year, so we have known for years that every now and then, we have to change out the tritium and we have accounted for that.

However, now, with no new designs and with the production complex in the state that it is at, with the financial picture where it is at, we are also getting into worrying about the other components, because, for instance, we have plutonium in these weapons now. Its half-life, instead of being 12.3 years, is 24,000 years. But nevertheless, plutonium is sitting there and changing all the while. It is changing by radioactive decay and making helium. It is changing by radioactive decay and actually changing its chemistry while it is sitting there over tens of years.

And when we were changing out these weapons in the tune of 20 or so years, we knew how to live with that particular problem.

Now as we are talking about perhaps having these weapons for 30, 40, 50 or more years, these problems become much more important to understand those effects of aging.

Likewise, we have high explosives. It is an organic material that is constantly changing. We have other organic materials that are out-gassing much like the dashboard, let us say, in your new vehicle. They tend to corrode other surfaces. And so we have a situation that is dynamic, constantly changing, and we are dealing with materials that are as complex as any known by man. That is why it takes this tender loving care, the constant attention by people who really understand nuclear weapons.

Likewise, we have the situation if we talk about enhanced surveillance. What we now try to get into are preventative aspects, let us say, preventative medicine rather than just going in, seeing if something is corroded, open up a gap and taking it out of the stockpile, trying to go in with much more science-based tools to try to understand the health of the stockpile, try to be able to predict when we must remanufacture and replace something.

The same thing goes for remanufacturing. My colleagues have already said they are working with the plants, trying to bring more of a science-based approach to integrate the research and development with the surveillance and then with the remanufacturing capability. So those people aspects are extremely important.

I must say, at my laboratory today, and I have good reason to say this because over the past week I have held five town meetings. Actually, the occasion for that was John Emory, who has met with this committee a number of times, is moving on from his job as Program Director for Nuclear Weapons Technology at Los Alamos and so I am about to replace John, and so I took that occasion to go and talk to our people, close to 500 of them, of what they thought about the directions, the issues in nuclear weapons technology.

I found an excitement that is based on this science-based stockpile stewardship and the fact that the military has really stood up and said, look, here are the sort of requirements that we see coming down the road, because they are worried about rebuilding, let us say the W–88 and the Trident 2 missile or other warheads. There is an excitement right now at the laboratory that I did not see there three or 4 years ago, and actually, Representative Dellums, you and I discussed that last year and you asked me, would not your people be turned on by the challenge of the science, and right now they are.

So the key issue, which has already been mentioned a couple of times, will the support be there to really continue that excitement, because in the end, if we do not have it, we do not have the right stockpile stewardship, and in the end we do not have the safety and we do not have deterrence. So I think those things are key and I ask for your continued support in that direction. Thank you.

[The prepared statement of Dr. Hecker follows:]

TESTIMONY OF SIEGFRIED S. HECKER,

DIRECTOR

LOS ALAMOS NATIONAL LABORATORY

HEARING

of the

SUBCOMMITTEE

on

MILITARY PROCUREMENT

COMMITTEE ON NATIONAL SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

March 12, 1996

TESTIMONY OF SIEGFRIED S. HECKER, DIRECTOR

LOS ALAMOS NATIONAL LABORATORY

MARCH 12, 1996

Mr. Chairman, thank you for the opportunity to testify before this committee. Los Alamos takes very seriously its national security mission in *reducing the global nuclear danger* and we stand ready to work with this committee to ensure United States leadership by our efforts in the stewardship and management of the nation's nuclear weapons stockpile, in nonproliferation and nuclear materials disposition, and in dealing with the nuclear legacy of the last 50 years.

The last year has been a significant one for nuclear weapons issues. In February, The Galvin Task Force on Alternative Futures for the Department of Energy (DOE) Laboratories issued its report endorsing science-based stockpile stewardship and calling for dramatic increases in productivity at the laboratories. Last summer saw the extension of the Nuclear Nonproliferation Treaty, followed closely by the President's declaration to seek a Comprehensive Test Ban Treaty (CTBT) with zero yield testing. Science-based stockpile stewardship was again put forward as the vehicle to ensure confidence in the nation's nuclear deterrent in the absence of nuclear testing. In September, the National Science and Technology Council completed its review of the major federal laboratories, concluding that

> "... the continued vitality of all three Department of Energy (DOE) nuclear weapons laboratories is essential to the nation's ability to fulfill the requirements of stockpile stewardship as we enter in a Comprehensive Test Ban regime."

Finally, in January of this year the START II treaty was ratified and, if approved by the Russian Duma, will result in significant reductions in nuclear forces and will eliminate the most destabilizing counterforce weapons.

As the Director of the Los Alamos National Laboratory, I must personally certify each year that Los Alamos weapons in the stockpile are safe, secure, and reliable. I must do this for an aging stockpile in the absence of nuclear testing and in the absence of new-design production. This is a significant responsibility, and I must rely on the Congress and the Department to help provide the resources that I need to keep my Laboratory vigorous and vital so we can accomplish this task.

There are four points that I would like to make today.

- *Under a CTBT regime with no nuclear testing, confidence in the nation's stockpile will require that we attract and retain first class scientists and engineers, build new facilities and upgrade existing ones, and develop new understanding. Science-based stockpile stewardship and management are incredibly difficult tasks.* ***To some extent we face greater challenges than any we have faced before,*** *challenges that we are already beginning to meet.*
- *We have an important role in other aspects of reducing the global nuclear danger, those involving the proliferation of weapons of mass destruction, the disposition of nuclear materials, and the cleanup of 50 years of nuclear weapons production. Again, we are already making a difference in these areas.*
- *Success in these tasks requires that we remain a scientific laboratory of the first rank, forming partnerships with universities so that we are allied with the best science in the world and with industry so that we are allied with the best manufacturing technology in the world;*
- *We have confidence that science-based stockpile stewardship and management can meet the nation's needs in nuclear weapons technology. The plan must be supported by the Department and the Congress now and over the long term. At the same time, we must demonstrate that we are as effective and efficient as we can be.*

I have included an appendix on the Laboratory's role in science-based stockpile stewardship. It presents in greater detail what is involved in terms of the Laboratory's activities and facilities. Let me now deal with each of these major points.

THE IMMEDIATE CHALLENGE OF SCIENCE-BASED STOCKPILE STEWARDSHIP AND MANAGEMENT

Since the beginning of the Cold War era, the nuclear weapons stockpile has been maintained through a strategy of surveillance, nuclear and nonnuclear testing, and an active program of new warhead design and replacement. Post-Cold War U.S. objectives of enhancing nonproliferation goals and seeking a Comprehensive Test Ban Treaty, while providing for the continued assurance of a smaller stockpile, have required that a new paradigm for stockpile stewardship be developed, without the conduct of underground nuclear testing and without new warhead design. We must also ensure that we can meet the needs of our military customers for a resilient and flexible stockpile management and remanufacturing complex.

A New Paradigm for Stockpile Stewardship and Management

Our approach to stewardship in this new era will rely on three interconnected thrust areas at Los Alamos:

1) Surveillance to allow us to examine and diagnose aging phenomena in stockpile weapons;

2) Assessment of the physical observations using detailed calculations and experiments to evaluate the safety and performance of each weapon; and

3) Development of appropriate responses based on those expert assessments, responses that may include modifications to, or remanufacture of, warhead components or changes to operational procedures.

Surveillance

We will continue our core surveillance program for annual sampling of a small number of stockpile units for inspection. In addition an Enhanced Surveillance Program will develop a new suite of tools and technologies to allow us to predict, up to ten years in the future, problems that may occur in the enduring stockpile. Examples of these technologies include:

- neutron radiography and scientific experiments in material science to characterize aging-related phenomena.
- resonant integral spectroscopy, which detects broken or damaged joints and degraded mechanical components;
- resonant ultrasound spectroscopy, which detects changes in properties of materials and parts as well as imbedded defects; and
- Superconducting magnetic field technology to detect corrosion;

These enhanced tools will enable us to anticipate the need for DOE to acquire or expand its manufacturing capacity *before* serious problems affect the stockpile. Enhanced surveillance will link science with the traditional core surveillance program in a way analogous to the interaction of biomedical research and clinical medicine; that is, we will not try just to address the symptoms of disease, but to understand the causes.

Assessment

Each time our surveillance activities uncover a potential problem in a stockpile system, we will rely on a combination of expert judgment, data retrieved from fifty years of nuclear testing, and modern calculational tools and experiments to fully assess safety and performance. Our investigation must be thorough and will require new tools to provide accurate predictions of stockpile performance for our military customers. Examples of assessments may include accident safety scenarios, weapon performance calculations with observed defects in stockpile components, and evaluation of the effects of aged weapon materials. The accuracy of these assessments will be paramount in providing expert technical judgments to the Department of Defense (DoD). Serious problems which may arise in the future could require consideration of the removal of a system from active inventory or modification of components. I take this stockpile assessment responsibility to be one of the most important in my role as Laboratory Director.

Response

Should the DoD and the DOE agree that action must be taken to correct an observed or predicted stockpile defect, the Laboratory must be ready to propose response options that:

- meet the needs of the military customer,
- can be certified,
- can be assured with high reliability , and
- can be produced within the national regulatory environment within DOE facilities.

The DoD clearly anticipated that responses of this type may be required in the future when it provided the basic DoD requirements for the nuclear weapons infrastructure in the Nuclear Posture Review. These requirements include demonstrating the capability to refabricate and certify weapon types in the enduring stockpile, as well as maintaining the capability to design, fabricate, and certify new warheads, although no new production is now anticipated.

What is required for success in this new paradigm?

To solve the problems that will confront the nation in this new era, the Laboratory is developing the enhanced capabilities required in computing, hydrodynamic studies, and materials science. Of course these new capabilities must complement the solid foundation provided by the core stockpile stewardship program. A dedicated national effort will be required to keep the core program strong so the next fifty years of the nuclear era will be as safe and successful as the last fifty years.

Core Stockpile Stewardship

The Core Laboratory Stockpile Stewardship Program underpins the technical basis for all U.S. nuclear weapons in the stockpile. Through this core program the Laboratory performs the fundamental research, the development of physical models, the integration of computer simulation codes, the experimental validation and the systems engineering which are required for the certification of stockpile systems. In addition the core stockpile stewardship program sets all technical specifications for manufacturing and surveillance operations as well as for maintenance activities conducted by the DoD. As part of the improved fundamental base needed for stockpile stewardship, we are performing experiments:

- to characterize the high stress properties of plutonium
- to establish the implosion characteristics of our current stockpile systems, and
- to verify safety assessments which ensure that all changes in procedures and operations are conducted with the highest standards of safety.

We are also working on issues involving the dismantlement of the retired stockpile, surveillance of warheads, and development of modifications for weapons in the stockpile. The Stockpile Life Extension Program is an example of an application of core capabilities to sustain the nuclear weapons that will remain in the stockpile and to extend the service life of warheads well beyond the original design life of each.

One of our most important responsibilities is to ensure that critical information from fifty years of nuclear weapons testing and development is properly preserved and transferred to formats that will enable this data to contribute to resolving future issues. We are formally reformatting Laboratory-wide records, from design calculations to engineering drawings, for electronic storage that will be accessible to future scientists. In the absence of nuclear testing, new computational models can be benchmarked with this existing nuclear weapons testing archive.

Without additional nuclear testing and new warhead development, science-based stockpile stewardship will require that the core stockpile stewardship program continue to provide the foundation of accurate and complete scientific on which all future stockpile surveillance, assessments, and modifications will be grounded.

Enhanced Computing Capabilities

Perhaps more than any other technology component of science-based stockpile stewardship, we will depend on high-performance computing and computational simulations to continue to validate and certify the safety, reliability, and performance of the nuclear package in the complete absence of nuclear testing. For decades, we have used computing as an extremely effective and critical tool in the design and development of new warheads, but its utility has always depended heavily on nuclear tests to supply specific data to calibrate the physics models in our codes and to proof test a final design. We must now take the lead in producing unprecedented advances in new computer hardware and software in order for computing to fulfill its new role of predictive simulations that can reliably assess the effects of aging and engineering modifications without new nuclear tests .

The Accelerated Strategic Computing Initiative (ASCI) was begun this year to develop a series of new high-fidelity computer simulation capabilities to predict a warhead's safety and nuclear performance and the fundamental effects of aging and reconstitution on its nuclear components. These codes will of course require all of the data that can be obtained from new experimental facilities (discussed in the next section) as well as archived data from past nuclear tests to develop and verify the necessary physics models. Code development will depend on our strong science base, long supported by the core program at Los Alamos, in such disciplines as weapons physics, materials science and numerical applied mathematics.

In order to run these codes effectively, Los Alamos and the ASCI program will also form R&D partnerships with the computing industry to develop computers and their supporting software a ten-thousand-fold more powerful than the largest machines readily available today. This dramatic gain will be accomplished in less than one decade rather than the three decades which would normally be required.

Los Alamos has pioneered the use of parallel computers in weapon safety assessments. We are now taking the lead in pursuing a new parallel computer design approach that involves clustering together hundreds to thousands of relatively low-cost, high performance commercial multiprocessor servers. We will establish a competitively-selected industry contract to develop this approach in the next few months. This contract and a supplemental procurement by our Advanced Computing Laboratory will build Los Alamos' computing power to four Teraflops in 1998 and will constitute another major step forward in our continuing world leadership in high performance computing and predictive simulation. We must maintain this leadership for us to do the job we have been assigned.

During the last week of 1995, Los Alamos weapon designers performed four very special calculations to assess the nuclear performance implications of an essential engineering modification that will be required to maintain a warhead in the active stockpile. These calculations ran 1,500 hours of equivalent Cray Y-MP processor time each. We were in fact fortunate that the specific engineering change could be explored with a two dimensional calculation requiring one million computational cells. In general, future stockpile assessments will require three-dimensional calculations, which in turn need 1000 times the computing memory and would take 100 years to perform on current machines. ASCI is an essential tool for computational assessments for stockpile stewardship.

Above Ground Studies of Weapon Performance

Understanding the hydrodynamic behavior of materials under extreme conditions is the single, most crucial component of the science of nuclear weapons design and performance. Improvements in computing will largely focus on large-scale simulations of hydrodynamic properties of implosions. These simulations will have to be validated by laboratory experiments. Let me focus for a moment on several important experimental facility-related initiatives at the three weapons Laboratories which have been designed to elucidate the physics of nuclear weapons without nuclear testing. Clearly, no single laboratory experimental facility can reproduce all of the physical conditions of a nuclear weapons. Therefore, the Laboratories have defined a suite of complementary experimental facilities which allow us to focus on different aspects of the physics of nuclear weapons.

Dual-Axis Radiographic Hydrotest Facility. The Dual-Axis Radiographic Hydrotest (DARHT) facility at Los Alamos is our highest priority among the experimental capability initiatives. DARHT will house a pair of advanced electron accelerators that will generate x-rays to provide high-resolution images of dense materials shocked or imploded by high-explosive detonations. Because two axes are planned, we will be able to make essential time-resolved or three-dimensional measurements (similar to a CAT scan) on nonnuclear implosions with sufficient accuracy to observe changes caused by aging processes. We also expect to incorporate improved accelerator technology into the second axis. DARHT's capabilities are essential to improving our understanding of hydrodynamic behavior of aged warhead pits and will be crucial in stewardship of the stockpile without additional nuclear testing. As the facility is developed, a phased implementation of containment of the debris will provide increasing environmental protection. The Department recently completed an environmental impact statement and a record of decision on DARHT. Construction is currently suspended until a current court injunction is lifted. We anticipate that this will happen in 1996. Since radiographic hydrotesting is at the top of our urgent needs list, we are continuing to fund advancements in technologies that would be used in future hydrotest facilities. This effort, funded from our core stewardship program, has resulted in advancements that could be implemented into the second axis of DARHT. These advancements in technology will enable multiple pulses (up to four) from a single accelerator during a test resulting in multiple images of the same implosion experiment at critical times.

Continuing to advance the tools available for hydrodynamic studies and experiments will remain a top priority and one in which the nation must continue to invest to ensure that stockpile stewardship under a comprehensive test ban is successful. At Los Alamos I have directed that investigation of additional technologies for improving this field be explored. One recent development that appears promising is the application of proton radiography for nuclear weapon applications. Proton radiography, which is currently under development at LANSCE, has the potential for increased penetration not achievable by traditional x-ray techniques.

Pulsed Power Experiments. Pulsed power in the microsecond regime, in current use at Los Alamos, enables highly precise, macroscopic hydrodynamics experiments associated with the physics of weapon primaries and secondaries. We will use these experiments to benchmark hydrodynamic calculations associated with potential physical defects caused by aging. In FY-1996 we received the first line item funds for our next generation pulsed power experiments facility, ATLAS, and preliminary design is underway. ATLAS is projected to be complete in 1999 and will provide capabilities to conduct weapon-related experiments to investigate implosion hydrodynamics and the behavior of materials at high strain rates.

During the past few months Los Alamos weapons designers have fielded a very successful experimental campaign on the nanosecond SATURN pulsed power facility at Sandia National Laboratory. Nanosecond pulsed power can generate a very powerful radiation source for radiation hydrodynamics experiments. We anticipate expanding our collaboration with Sandia on radiation flow experiments when the PBFA-Z facility becomes available in a few months.

Laser Experiments. High-energy lasers and electrical pulsed-power facilities are complementary tools in addressing high-energy-density physics associated with nuclear weapons stewardship, making different aspects of the high-energy density regime accessible to experiments. Los Alamos has for a number of years conducted Inertial Confinement Fusion (ICF) and weapons physics experiments at the NOVA laser at Lawrence Livermore National Laboratory.

The National Ignition Facility (NIF), which will be sited at Livermore, will be able to approach the temperatures and pressures that occur in a nuclear weapon on a small scale. NIF will provide an experiment facility for the study of thermonuclear ignition in ICF targets. Weapons physics applications at NIF will include investigations of plasma equation-of-state properties, hydrodynamic instabilities, opacity, and radiation transport

Material Science Applications for Nuclear Weapons

As the stockpile ages our focus must also change to place greater emphasis on the science of aged weapon materials. For example: organic materials, such as high explosives, will degrade over time and will have to be replaced; outgassing of organic materials may also lead to corrosion; cracks or voids will likely develop in some components and assessments of the impact on performance will require additional research to accurately characterize such defects; radioactive decay products which will build up over time in the plutonium components and the change in material properties must be more confidently assessed; and minor but potentially important dimensional changes will occur in the weapon systems. These effects due to aging must be characterized and integrated into our codes and experiments to enable accurate assessments and predictions of future weapon performance.

Application of Neutron Beams. Researchers are using the Los Alamos Neutron Science Center (LANSCE) to address many issues associated with aging by applying highly developed materials science expertise in neutron diffractometry, small-angle scattering, reflectometry, and inelastic scattering. LANSCE is already supporting improved fundamental understanding of the science underlying models for predicting the behavior of explosively compressed plutonium, the surveillance of light materials deep inside an aging nuclear device, and the study of the performance and sensitivity of high explosives. The high-intensity, high-energy neutron beams are also useful to test methods for locating defects nondestructively with neutron radiography. There are many smaller yet exciting research developments as well. LANSCE operated with its highest reliability ever last year and is scheduled to increase the number of experiments in support of stockpile stewardship as well as Accelerator Production of Tritium in the coming year. I believe that LANSCE will continue to demonstrate its long-term importance to the weapons program by applying new techniques to study key stockpile issues.

Subcritical Experiments at the Nevada Test Site. Plutonium components in our nation's stockpile were normally retired before reaching twenty-five or thirty years of life. This new era of stewardship will require that we increase our confidence in the performance factors associated with aged plutonium and other weapon materials. Subcritical experiments, consistent with a zero-yield CTBT, at the Nevada Test Site will address these concerns by obtaining data which will enable us to more accurately calculate the behavior of these materials in extreme environments.

What is the Product?

The product of stockpile stewardship will be the life extension and revalidation of weapons in the enduring stockpile without reliance on nuclear testing. Responses to observed or predicted problems will be implemented to ensure that the requirements of the DoD are met. In January 1996, the DOE and the Laboratories implemented a new, robust form of peer review for warheads. Los Alamos, in concert with Lawrence Livermore National Laboratory, embarked on a four year study of the W76 warhead for the Trident I missile, the first warhead to be revalidated by this process. Two independent teams will review archival data, recalculate weapons performance, investigate surveillance data, and conduct new experiments and computer calculations. This new process will require the effective use of historical data as well as the latest advanced technologies to determine if the warheads in the remaining stockpile are safe and reliable, to predict if potential problems lie ahead, and to propose and develop modifications that will ensure the reliability of our nuclear deterrent. Stockpile stewardship must not only provide confidence to the DoD customer in the near term, it must also ensure that we make the right choices today so our ability to provide that confidence remains strong over the long term.

Stockpile Management

An essential element of DOE's strategy to assure the safety and reliability of the nuclear weapons stockpile is the capability for the maintenance, surveillance, and refurbishment of the weapons stockpile. This stockpile management element is the necessary complement to stockpile stewardship. The DOE has just released its draft of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSM-PEIS). The announced preferred alternative in the SSM-PEIS is to downsize in place at some production plants and transfer other assignments, where appropriate, to the Defense Program laboratories. I believe that the significantly reduced production requirements combined with no nuclear testing and long lifetime requirements for weapons in the stockpile will require a tightly integrated R&D effort, an enhanced surveillance activity, and a flexible remanufacturing system. The preferred alternative will require very close collaboration between the laboratories and the remaining plants. At Los Alamos, we have already seen the benefits of such integration in improving the quality and lowering the costs of those surveillance and manufacturing operations that have been transferred to us from the plants at Mound, Pinellas, and Rocky Flats over the past year. Let me present a few specific examples.

Pit Surveillance and Rebuild

In pit surveillance, we met our annual goal of evaluating 19 surveillance pits one month ahead of schedule, introduced scientific evaluation methods, converted surveillance and inspection records to electronic storage, established a CD-ROM reporting format, and linked surveillance and archiving for the first time.

In pit rebuild, we completed the transfer of necessary Rocky Flats hardware and gauging equipment, developed a smaller and more accurate inspection gauge, eliminated a hazardous fluid previously used in density measurements, switched to dry machining so that we could eliminate chlorinated hydrocarbons and fluorocarbons for component cleaning in favor of recyclable supercritical carbon dioxide, and initiated a modern and simpler quality control program for production.

Detonator Manufacturing

With the shutdown of operations at the Mound Plant in Ohio, the Department assigned detonator evaluation and manufacturing responsibility to Los Alamos. We have demonstrated the capability to perform the evaluations; completing the first one late in 1995. Included in the assignment to fabricate detonators for the future stockpile is the design and manufacture of detonator simulators used in stockpile evaluation flight test units. Though these simulators do not actually enter the nuclear stockpile, we have demonstrated the ability to meet the same rigorous war-reserve quality standards as those required for stockpile components.

Fabrication Support

In FY-1995, we also demonstrated the capability to manufacture other parts used in the physics package so that we could support our local hydrotesting program. For example, we cold pressed to specified density and machined several lithium salt parts, measurably reducing waste generated. We also fabricated our most challenging nuclear package case from a uranium alloy. Finally, we are making good progress in the process of casting uranium to nearly final shape.

Neutron Generators

Los Alamos also was assigned responsibility for the tritium loading of neutron tubes for a neutron generator designed by the Sandia National Laboratories. Although it was expected to take up to five years to transfer the skills needed to perform this work, Los Alamos researchers applied their knowledge of tritium hardware and processes and transferred the production capability to the Laboratory with significant improvements. The result is a system that is providing deuterated targets and will provide tritiated targets to Sandia National Laboratories for incorporation into neutron generators on schedule within months instead of years. The improved process also reduced radioactive waste generated by 90 percent.

Plutonium Pit Manufacturing

The preferred SSM-PEIS alternative for pit manufacturing calls for a limited-scale production of pits at the Los Alamos TA-55 plutonium facility, the only facility in the nation currently able to tackle such an assignment. We are aggressively supporting this decision because we believe that pit manufacturing at the level of approximately 50 pits per year would greatly complement our current R&D and surveillance missions, while concurrently saving the taxpayers a lot of money.

We are developing a plan that would put in place the capacity to build 50 complete pits per year on a single-shift basis. The interior equipment and utilities in one wing of the plutonium facility will be rearranged so that we have an integrated production and R&D area. To meet the projected build requirements of the military, we are placing the plutonium facility project on a fast-track internal validation and review for submission as a new construction start in the FY 1998 budget.

We will be in very limited pit production for the W88 warhead for the Trident II pit rebuild program (rebuilding units destroyed in surveillance) during FY-1998. Getting started as soon as possible is important to meet the Navy's requirements and to capture the pit production knowledge base before it is lost. No war reserve pits have been manufactured in the United States since Rocky Flats shut down its plutonium operations in June, 1989. By employing the integrated R&D, surveillance end remanufacturing paradigm, we expect to improve the existing fabrication processes, minimize waste generation, and reduce worker radiation exposure. In addition, the hands-on manufacturing operations will help to maintain rigorous nuclear weapons safety practices among our scientists, engineers and technicians.

We are also teaming with colleagues at Lawrence Livermore, Savannah River, and Pantex to develop contingencies for larger-scale pit-production requirements. We expect to learn much from the W88 pit rebuild program and the 50-pit manufacturing module at TA-55 that would allow the team to design a modular, large-scale production capability that could be deployed rapidly should requirements change. I should add that such teaming is also occurring with Savannah River, Pantex, Allied-Signal Kansas City, and the Y-12 plant to address other nuclear weapons component production capabilities. In all cases, we will use the integrated R&D, surveillance, and remanufacturing paradigm.

Nuclear Facility Upgrades at Los Alamos

In addition to the TA-55 facility upgrade to handle the small-scale pit manufacturing mission, Los Alamos has two other facilities that will require substantial upgrades or life extensions to meet the missions envisioned in the SSM-PEIS. The Chemistry-Metallurgy Research (CMR) building and the Nuclear Materials Storage Facility (NMSF). The CMR building is 44 years old and houses the analytical chemistry laboratories that are crucial to the operations of the TA-55 plutonium facility. Plutonium operations at TA-55 would shut down within weeks if the CMR building were to be shut down. The CMR facilities also provide the nuclear material standards for all other sites through distribution by the New Brunswick Laboratory. Upgrades of the CMR have been ongoing for the past few years. We expect continued funding to be included in the President's FY-1997 budget submission.

Since Los Alamos recently took over the pit surveillance program we will also be in desperate need of renovating the Nuclear Materials Storage Facility because the vault at TA- 55 is projected to be at capacity by the year 2002. The renovation project of the NMSF is needed to allow it to accept special nuclear material in that time frame. The total project cost is $56.7 million, and is expected to be funded in the FY 1997 DOE/DP budget as a new start.

Collectively, these three facilities projects provide the foundation for maintaining our ability to meet the Department's plutonium needs, including surveillance and limited pit manufacture, in a safe, reliable, and environmentally responsible manner. These modernized facilities represent the cornerstone for ensuring the continued reliability of primaries in the nuclear stockpile.

Tritium Supply

In December, 1995, the DOE announced a dual track approach to ensure a supply of tritium for the nuclear stockpile. This dual approach involves a commercial, light-water reactor path, either purchased or leased, and an Accelerator Production of Tritium (APT) project. Los Alamos is the technical lead for APT but we are collaborating closely with Westinghouse which operates the Savannah River plant which has been designated as the preferred production site for APT if APT is selected as the preferred technology. We are also working closely with Brookhaven, Lawrence Livermore, and Sandia National laboratories. This team will be augmented by a prime contractor to manage the construction project in August, 1996.

The activities at Los Alamos are focused on engineering design and development over the next three years to reduce the cost- and schedule-risk associated with the project. We are prototyping system components to understand costs and fabrication issues and are investigating new technologies that project 20-40% savings in the estimated operating costs of $200 M for the APT plant. Technical risk for the project is relatively low based on evaluations by independent expert review committees. We passed a significant milestone this year by constructing and operating a prototype of the first stage of the accelerator that met its technical requirements.

I am confident that this project is on track to start tritium production at Savannah River in 2007. However, I do have concerns that the budget profile for the next two years (FY-1997-1998) is not consistent with a 1998 decision between the commercial reactor and APT. The combined FY-1997-98 budget amount is adequate but the FY-1997 level of $85 M is low by about $45 M to achieve all the milestones prior to the decision point.

This is an exciting project for the laboratories, industry, and the DOE. It involves an important national problem and uses the core competencies of all of the participants in an effective manner. I believe APT will produce tritium for the country in a reliable manner with minimal environmental impact.

Los Alamos' Approach to Stockpile Stewardship and Management

Our approach to stockpile stewardship in this new era supports the national goals of ensuring the highest standards of confidence and reliability in our stockpile without reliance on nuclear testing. Our approach is science-based to ensure that no fundamental detail of weapons science or engineering is overlooked. This approach will be complemented by nonnuclear experiments, inspection and surveillance of stockpile weapons, and state-of-the-art calculational codes to simulate and predict every aspect of weapon performance. We will, in partnership with the plants and our DoD customer, ensure that the necessary modern manufacturing infrastructure is in place to meet the future needs of the stockpile in a timely way. My responsibility, as Director of the Laboratory, for certifying the health of the Los Alamos warheads in the stockpile, can only be met through a comprehensive, integrated program of surveillance, assessment, and response I have outlined above.

THE CHALLENGES OF PROLIFERATION, NUCLEAR MATERIAL DISPOSITION, AND CLEANUP

Beyond ensuring a safe, effective, and reliable nuclear deterrent now and in the future are other significant challenges involved in *reducing the global nuclear danger*. We must help ensure that the capability to produce nuclear weapons and other weapons of mass destruction does not spread to other nations or terrorist organizations; we must secure the safe storage and disposition of many tons of plutonium and highly enriched uranium; and we must help clean up the legacy of 50 years of nuclear weapons development and production. This involves efforts both here and abroad to develop new technologies as well as to apply them.

Nonproliferation and Verification Activities

The proliferation of weapons of mass destruction (nuclear, biological, and chemical) and possible terrorist use of these weapons remain a major national security issue. Recent developments, from allegations of nuclear smuggling out of the former Soviet Union, to the terrorist use of nerve gas in a crowded Tokyo subway, to the rapid diffusion of technologies applicable to the manufacture of biological weapons, have heightened awareness of this threat.

The principal technological measures for responding to such a threat consist of controls on sensitive materials, weapons and technology; early detection of potential proliferators and proliferation pathways; and the ability to respond to threatened attacks with effective interdiction and protection measures. Adequate intelligence and monitoring capabilities require the application of leading edge science and technology across a broad spectrum.

High priority should be given to intelligence collection and threat assessment as a tool in developing national response options. Equally, better detection, monitoring, and data collection technologies are needed across the spectrum of nuclear, biological and chemical threats. Adequate preventive measures, including verifiable arms control agreements as well as export controls for some of the threats are also lacking. A key to the success of this effort will be a strong R&D program to support technology development and evaluation and assessment activities across government agencies. The best talent of the Defense Program laboratories should be brought to bear to meet these challenges.

The Defense Program laboratories are developing much of the technology that will be used to verify a Comprehensive Test Ban Treaty. This includes technologies for the international monitoring system such as infrasonics, hydroacoustics, radiochemical sampling, and seismic monitoring at regional distances. In addition, at Los Alamos and Sandia, we are developing sensors for new U.S. satellites that will fly after the year 2000 to verify the Comprehensive Test Ban and monitor for nuclear explosions worldwide. Confidence building measures to encourage compliance with the zero-yield threshold will also be vital to provide the necessary assurance that other nations are acting in good faith.

Lab-to-Lab Initiatives

Starting in 1994, at the behest of then DOE Undersecretary Curtis, Los Alamos took the lead in responding to concerns regarding the control of weapons and nuclear materials in the former Soviet Union by suggesting a "laboratory-to-laboratory" approach to the problem. In one weekend the principle was accepted by scientists at Arzamas-16. Within six months we were demonstrating the first complete nuclear material control and accountability system with the Russians at their key facilities.

Now, all the major Russian Ministry of Atomic Energy facilities have become participants in the program, along with six U.S. national laboratories. As an example of an early result, we took several components that constituted a major facility demonstration at Arzamas-16 and installed them at the Research Institute for Physics and Engineering in Obninsk. This facility, with two critical assemblies, now has 800 kilograms of plutonium and 2.3 tons of highly enriched uranium under positive safeguards. We are planning to help the Russians field safeguard systems for their weapons assembly and disassembly plants as well. At the current rate, we expect the Russians to have all of their weapons-grade nuclear material under strict control in five to seven years.

The window of opportunity we have open to us now must not be lost. We need to expand these efforts as expeditiously as possible to include protection of the materials at the nuclear sites, as well as detection of theft or diversion of these materials. In the meantime we need to continue to support our nuclear emergency search capability, in case control efforts should fail.

Nuclear Material Disposition

The U.S. also faces an enormous challenge in managing and safeguarding the huge quantities of nuclear materials from dismantlement of its own nuclear weapons, as well as material remaining at former production plants. The latter challenge involves tons of plutonium and highly enriched uranium in a variety of forms in many locations. We must move expeditiously to convert these materials to highly protected, storable forms, while at the same time maintaining adequate safeguards.

Los Alamos provided technical support in material stabilization to the new management contractor at Rocky Flats Plant, including input to project plans, peer review of proposals, development and demonstration of specific processes, and on-site training for the Rocky Flats operations staff. Last December, we also assisted as a ton of plutonium oxide was placed under International Atomic Energy Agency (IAEA) safeguards at the Rocky Flats site. We are leading the development of a novel Automated Retirement and Integrated Extraction System (ARIES) for plutonium components to convert the cores from dismantled nuclear weapons into unclassified forms suitable for safe storage and safeguards monitoring. The ARIES process for dismantling pits has virtually eliminated aqueous waste streams, cutting future costs dramatically. ARIES, which won an R&D-100 Award, is also being developed as a modular process for potential application to the stabilization of Russian nuclear material.

In support of materials disposition efforts, Los Alamos has studied the phenomenology of plutonium metal and oxide in storage in order to develop criteria for safe long-term storage of these materials. Material characteristics that could result in corrosion or pressurization of sealed storage containers were analyzed to provide the fundamental technical basis for safe long-term storage of plutonium. We have since packaged twenty five canisters of plutonium that meet the long-term storage criteria in unclassified form potentially acceptable to the IAEA. The plutonium is contained in two nested stainless steel cans that are welded and individually leak tested. This activity will continue through the next several years to stabilize and repackage the Los Alamos plutonium inventory. Los Alamos is currently the only site with plutonium in approved long-term storage.

Environmental Management

We must also continue to work to provide the most cost-effective program of environmental remediation and waste reduction to reduce the danger from the legacy of 50 years of nuclear weapons development and production and to integrate these efforts with waste minimization from continuing activities. There is an urgent need to coordinate efforts in reducing the amount of waste produced and upgrading waste processing facilities. For stockpile stewardship and management to be successful, it must avoid long-term environmental costs and address critical production risks and vulnerabilities.

The national laboratories have the technical expertise and the engineering capability necessary to support developing and applying advanced technology to meet near- and long-term environmental challenges across the DOE complex. In addition to the ARIES process discussed earlier, two other Los Alamos technology developments with application to waste minimization issues received R&D-100 Awards last year. We developed a new type of chemical microsensor that can be used to monitor airborne organic contaminants that unlike earlier types, can be made specific to particular compounds and that has long-term stability. Our researchers, with collaborators from Boeing, also developed a polymer filtration system to recover heavy metals from electroplating solutions, a technology that could avoid the formation of more than 50,000 tons of metal-containing sludge annually.

We are also applying our expertise to assist the Department in its remediation efforts at other sites. We have assisted in the characterization of the waste in the high-level nuclear waste storage tanks at Hanford, delivering the first comprehensive estimate of the chemical contents of these tanks. This effort has resulted in new safety assessments that will allow more complete characterization and eventual retrieval of tank wastes.

Because Los Alamos has significant waste-generating operations, it has hands-on knowledge of the processes that must be improved to generate much less waste. The Laboratory is working to ensure that waste minimization and pollution prevention play a pivotal role in all our activities. As our waste management operation becomes more sophisticated, we will have less need to handle "end-of-pipe" problems; instead, we will focus on preventing waste from entering the pipe.

We have also made significant progress in environmental restoration at our own site. We cleaned up forty-six contaminated sites and completed the decontamination and decommissioning of several buildings in our former plutonium fabrication area (the predecessor to the Rocky Flats Plant), reducing the airborne emission of radionuclides from this facility by 90 percent. Nearly 900 potentially contaminated sites have been evaluated and closed out, needing no further action. Between 70 and 120 contaminated sites are slated for cleanup in the next year, depending on funding levels.

KEEPING THE LABORATORY VITAL IN THE LONG TERM

The Laboratory's identity and international recognition rest upon its sustained performance in satisfying national needs in science and technology and in the quality of the science and technology it applies to its mission. It is no coincidence that Los Alamos is embedded within a major research university. Association with the University of California not only assists us in recruiting the best talent available, it reminds us that science and excellence provide the basic foundation for success in our mission. We can take the long-term view of a government laboratory, yet we have the talent that allows us to move rapidly into emerging areas of science and technology. A good example of the synergy that occurs between basic science and our mission was recognized last fall when Fred Reines, now Professor of Physics-Emeritus at the University of California-Irvine, received the 1995 Nobel Prize for Physics for his discovery, with the late Clyde Cowan and others, of the free neutrino. The 1953 discovery by these two Los Alamos researchers, was made possible by the development of large liquid scintillation detectors at Los Alamos.

Programs in civilian science and technology, supported by other Department of Energy offices such as the Office of Energy Research, as well as work for other federal agencies in the civilian and conventional defense sectors, help support capabilities necessary for the performance of our national security mission. Further, maintaining the quality of the Laboratory's work requires that our scientists be integrated into the broader scientific and technical community. Whether in basic research, the human genome or other bioscience programs, materials R&D, energy technologies, high-performance computing, space systems, or the application of Laboratory-developed technologies to industry, activities in civilian and conventional defense R&D serve important national needs while helping to maintain the vitality of the Laboratory. As we apply our core competencies to these needs, we advance those competencies needed for the weapons program and enhance the reputation of the Laboratory for quality science and technology. In these areas, we interact strongly with university researchers, and we are increasingly working in partnership with industry to help meet mission requirements.

Industrial partnerships are a critical factor in accomplishing our mission. Support for these partnerships was initially prompted by the government's desire to encourage effective utilization of technologies developed within the national laboratories at taxpayers' expense to help U.S. industries compete successfully in the global marketplace. We find that today the strongest rationale for these partnerships is that they are a business necessity for the laboratories to meet their own national security mission responsibilities.

The laboratories have much to learn from industry, both technically and from industry's operational best practices. Industry provides technical challenges that exercise and stretch the skills of our best scientists, thereby maintaining and enhancing capabilities for defense missions while helping the laboratories to provide the breadth of projects that enable them to continue to attract top quality scientific personnel.

For example, the Laboratory has been developing large-scale plasma source ion implantation, a technique pioneered at the University of Wisconsin, in a partnership with General Motors. General Motors has been willing to invest in the partnership because of its interest in the ion implantation to extend the life of cutting tools. The weapons program is benefiting directly from this work in two very different applications. The plasma expertise maintained by this project has been applied to ion implantation of ceramic metal-oxide components for nuclear weapons. In addition, large-scale plasma processes are being explored to strip plutonium contamination from objects like glove boxes, making them much easier to dispose of or making them suitable for reuse.

The nation's R&D enterprise will be strongly networked in the future. The Laboratory must be an integral part of that network. To be the best in science, we will have to work closely with universities. To be the best in technology, we will have to work closely with industry.

BUDGET RESOURCES AND HOW EFFICIENTLY WE USE THEM

Over the past two years the Department of Energy, with input from the military and in conjunction with the defense laboratories, has developed a sound plan for stockpile stewardship and management to the year 2010. This plan is responsive to the immediate needs of the military customer and it also provides me, as director of the Los Alamos National Laboratory, with the best hope to assure stewardship in the year 2010 and beyond in the absence of nuclear testing.

As I have pointed out above, the absence of nuclear testing and the inability to replace old designs with new ones represents a new paradigm for nuclear weapons. It will be very difficult and it will require substantial resources. This problem is exacerbated by the fact that the old DOE production complex is outdated and not well suited to do the necessary component manufacturing in the future. In developing the stockpile stewardship and management plan at the time of the President's decision to seek a zero-yield CTBT, we identified the need for a $4 billion budget for DOE Defense Programs for FY-1997, increasing slightly for close to 10 years, before decreasing to a steady state of approximately $3 billion in the out years.

At Los Alamos, we shoulder an especially heavy load because we will be the stewards of the majority of the weapons systems in the enduring stockpile. We will have to provide the core support for the current systems, develop enhanced surveillance techniques to ensure the future health of the stockpile, strengthen the tools that we will need to compensate as best we can for not being able to conduct nuclear tests, and ensure the nation's ability to remanufacture key components of weapons systems. Our Laboratory has an urgent problem of providing adequate funding to replace retirees in a few key skill areas, update and maintain our facilities (many of which are one-of-a-kind), as well as to operate our facilities safely and in an environmentally acceptable manner.

All of this translates to a need for a DOE-Defense Programs budget of $4 billion in FY-1997 for Weapons Activities. We have not yet received official notification of the President's budget request. However, any reduction below the $4 billion level will not allow us to build the required foundation for the stockpile stewardship and management program. We would be forced to choose between cutting back our support for current systems and constructing the building blocks for the future. Neither is acceptable in my opinion. I say this with full knowledge of the great dilemma that Congress and the President face in trying to achieve a balanced federal budget. I ask for this committee's understanding and strong support of our needs.

I recognize that to gain your support we must demonstrate not only that we have a compelling national mission but that we spend the taxpayers' money effectively. We have to demonstrate that government organizations, like private companies, are serious about reducing costs and increasing productivity. Working with the Department of Energy, we are trying to take unproductive, bureaucratic work out of the system and to reduce our overhead costs by eliminating positions no longer required. The Laboratory took a big step in this direction with the elimination of 915 positions last fall, saving an estimated $60 M in overhead expenses.

SUMMARY

It is now time to get on with the job of science-based stockpile stewardship—putting together the expertise and the experimental and theoretical apparatus to make the job possible. This is a job that has never been done before and in many ways is a greater challenge than any we have faced in over fifty years of nuclear weapons design and development. At the same time we must continue to ensure that our nuclear weapons are safe, secure, and reliable with vigorous management of the stockpile through surveillance, assessment, and remanufacturing, if necessary. We must also address the issues of disposition of nuclear materials here and abroad, the threat of proliferation of weapons of mass destruction, and the efficient cleanup of 50 years of nuclear weapons development and production.

We are on our way to a new world in nuclear weapons stewardship. To complete the job we must have the sustained support of the Department of Energy and the Congress. I thank you for giving me the opportunity to address these issues and I look forward to working with the Committee to assure that the our nuclear deterrent forces meet the nation's needs now and in the future.

Mr. HUNTER. Thank you very much, Dr. Hecker.

Dr. Smith, we will let you wrap this thing up here.

STATEMENT OF DR. HAROLD P. SMITH, JR., ASSISTANT TO THE SECRETARY OF DEFENSE FOR NUCLEAR, CHEMICAL, AND BIOLOGICAL DEFENSE PROGRAMS, U.S. DEPARTMENT OF DEFENSE

Dr. SMITH. Thank you very much, Mr. Chairman. I appreciate the opportunity for the Department of Defense [DOD] to comment on the questions and challenges regarding nuclear weapons that you have posed here this morning.

I would like to submit my written statement for the record and restrict myself to a very few brief comments. First, it seems to me that DOD should comment on the stockpile and I am pleased to do so. We find the stockpile today to be safe, secure, and reliable. It does indeed meet the requirements of the Department of Defense.

Testimony before me has really raised the question, will it remain so, particularly in an era without nuclear testing? We think the answer is yes, and one point that has not been emphasized to date and I would like to emphasize now is we are talking about maintaining a static stockpile. If we had to improve that stockpile, it would be an entirely different matter. The DOD is confident that we can develop the plans and programs with adequate budgeting to maintain a static arsenal.

What does it take? It takes adequate budgeting, thorough planning, steady effort, and these are, indeed, underway. More than that, it takes, in the words of General Jaolin, “One team, one fight.” Dr. Reis and myself, in particular, have been sitting side by side through congressional testimony in various meetings, including the Nuclear Weapons Council, to develop a coordinated, thorough program. On the Department of Defense’s side, my office, the strategic command, the Army, Navy, Air Force, Defense Nuclear Agency, are all represented, and at the same table are the Department of Energy’s representatives.

Let me just quickly point out a few examples of where this “one team, one fight” has been doing an excellent job. First of all, tritium has already been discussed at length by my colleagues. The Department of Defense is quite pleased with the dual-track decision. The one using commercial reactors is fraught with legal difficulties. As an engineer, I am confident that DOE’s lawyers can solve the legal difficulties. The other, the accelerator-produced tritium, is fraught with engineering difficulties. There, of course, I know a little more, and I am concerned. Hence the need for dual track.

We applaud the Secretary’s decision to postpone which track to pursue until 1998. To my mind, that is good business practice and does allow the Department of Defense to look forward to adequate tritium in the year 2005 if we follow the START I levels and certainly by 2011 if we follow the START II.

A second example, dual revalidation. In this case, thanks to Secretary O’Leary’s decision to maintain the Livermore Laboratory, we at the DOD can look forward to independent reports from each laboratory on each weapons system delivered without abridgment to my office. At the same time, the Department of Energy has been most cooperative in allowing members of the Department of Defense to begin to assemble at the various aspects of the weapons complex.

That is, members of the Department of Defense are now already beginning to work shoulder to shoulder with their colleagues in the laboratories and in the plants to ensure that we become what I discussed last year as the smart customer. We will have our own people, not there as Inspectors General, but we will have them there as colleagues to make sure that we begin to understand in great detail all aspects of nuclear weapons.

A third example, the Nuclear Weapons Stockpile Memorandum that Mr. Curtis mentioned had been signed by the President last Monday. That was a brand new approach to the stockpile management. We actually provided two tracks, one aimed at START I, the other aimed at START II. Secretary Perry has been quite clear that until START II enters into force—that means more than ratification—until it enters into force, we will follow the hedging track. That is, we will adhere to START I levels.

Another example, the Nuclear Weapons Council standing committee that I chaired recently reviewed remanufacturing capability with emphasis on the most difficult part of a nuclear weapon, namely the primary, and we reviewed it with great care at the action officer level and at the standing committee level. We are satisfied that we can indeed remanufacture the critical components of the primary, and I want to emphasize that remanufacturing is the key to all of this. We are not asking that our weapons last forever. We are simply asking that we recognize when they need to be remanufactured and then have the ability to remanufacture. The Nuclear Weapons Council standing committee is satisfied that we are embarked on the right approach to develop just that kind of capability.

I will stop with the examples at that point, Mr. Chairman. I hope that this testimony and the answers to your questions will provide confidence that in this new era of no testing and static arsenals that the Department of Defense and the Department of Energy are collectively, collegially, and effectively responding to the challenge of this era. I look forward to your questions, sir.

[The prepared statement of Dr. Smith follows:]

Statement of

The Assistant to the Secretary of Defense (Nuclear & Chemical & Biological Defense Programs)

Dr. Harold P. Smith, Jr.

before the

House National Security Military Procurement
Subcommittee

March 12, 1996

Mr. Chairman and members of the Subcommittee, I am honored to have this opportunity to appear before you. I will begin by stating that, today, the stockpile is safe, secure, and reliable. My remarks will focus on the shared responsibility between the Department of Defense (DoD) and the Department of Energy (DOE) to assure high confidence in the Nation's nuclear stockpile. This responsibility presents a new challenge because the nuclear weapons in our stockpile will be retained well beyond their intended design lifetimes without the benefit of underground nuclear testing.

The President recognized this challenge for the nuclear weapons program in his August 11, 1995 speech announcing the US position on a zero yield Comprehensive Test Ban Treaty (CTBT): "In order for this program to succeed, both the administration and the Congress must provide sustained bipartisan support for the stockpile stewardship program over the next decade and beyond. I am committed to working with the Congress to ensure this support." The President further directed a new annual certification to assure the safety and reliability of the nuclear stockpile. Finally, he stated that he would be prepared to "exercise our supreme national interest rights under the CTBT in order to conduct whatever testing might be required" if a high level of confidence in the safety or reliability of a nuclear weapon type could no longer be certified. With this challenge and commitment in mind, I will review some of the changes in the nuclear weapons program and actions that are being taken to ensure that we -- and our potential enemies -- continue to have high confidence in the stockpile.

The end of the cold war has wrought significant changes in the nuclear weapons program. Over the last decade, there has been an unprecedented shift in emphasis from design, development, fabrication, and testing of new warheads to refurbishment and life extension of existing warheads. Our stockpile has been reduced in size and diversity of weapon types and, by the end of this fiscal year, the current inventory will become the oldest in US history. Today, we do not have the capability to manufacture replacements for the nuclear warheads that comprise our existing stockpile. We must comply with environmental requirements that are increasingly challenging and litigious. The extended underground test moratorium has evolved into a US position for a zero yield CTBT. Finally, without the traditional yardstick of underground testing, it will become ever more difficult to replace the shrinking cadre of nuclear weapons experts. These changes have forced a shift in strategy at the Departments of Defense and Energy and were addressed in the DoD's Nuclear Posture Review.

The Nuclear Posture Review

Approved by the President in September 1994, the Nuclear Posture Review (NPR) continues to provide the DoD policy guidance, force structure, and stewardship obligations for the enduring nuclear weapons stockpile. The NPR codified the national policy of "lead and hedge" as our approach to nuclear weapons and the attendant technology infrastructures. The policy of "lead and hedge" simply means that the US will "lead" strategic arms control efforts toward START II or smaller force levels, but retain the ability to "hedge" by returning to START I levels.

Although primarily a DoD document, the NPR contains infrastructure requirements for the Department of Energy to ensure high confidence in the enduring stockpile, namely:

--- Maintain nuclear weapon capability without underground testing or the production of fissile material;
    -- Develop a stockpile surveillance engineering base;
    -- Demonstrate the capability to refabricate and certify weapon types in the enduring stockpile;
    -- Maintain the capability to design, fabricate, and certify new warheads;
    -- Maintain a science and technology base;
--- Ensure tritium availability, and;
--- Accomplish these tasks with no new-design nuclear warhead production.

To meet these requirements, we must provide an environment for the development of nuclear experts who can meet tomorrow's ever increasing challenges. The DOE, with assistance from the DoD, is pursuing a Stockpile Stewardship and Management Program to meet NPR requirements.

The Stockpile Stewardship and Management Program (SSMP)

As DOE continues to address NPR infrastructure requirements, the SSMP will provide a structured approach to deal with the lack of underground testing and no new nuclear weapon production. In the past, underground nuclear testing was the ultimate arbiter of the stockpile. Absent this arbiter, the DOE must develop new approaches to ensure high confidence in our nuclear deterrent. The SSMP must include: 1) enhanced surveillance of the stockpile, 2) expanded computational capability such as the Accelerated Strategic Computing Initiative (ASCI), 3) above ground experimental facilities (AGEX), 4) subcritical plutonium experiments at the Nevada Test Site and the ability to return to underground testing , 5) a limited capacity to remanufacture warheads in the existing stockpile, and 6) an assured source for tritium.

The DoD is satisfied with the progress that is being made by the DOE to fulfill its responsibilities as delineated in the NPR, but much remains to be done. For example, The Nuclear Weapons Council (NWC) endorses the DOE's dual track approach of pursuing a commercial light water reactor and accelerator produced tritium (APT) sources, but both approaches must overcome technical and institutional challenges. In the case of warhead fabrication, we must first establish a baseline capacity to replace those warheads routinely consumed by the quality assurance and reliability test program (QART) and be capable of expanding this capacity to handle precipitous failures of a type of warhead. We must be ever more vigilant in the stockpile surveillance program and demonstrate that systemic failures can be anticipated with sufficient time to implement corrective actions. The two Departments must continue to certify high confidence in the stockpile without the benefit of underground nuclear testing.

Maintaining High Confidence in An Aging Stockpile

In its effort to improve its corporate expertise in aging nuclear weapons, the DoD is becoming a more active partner with the DOE as warheads and components are assessed and certified. At the individual level, the DoD will increase the number of personnel assigned to the DOE weapon laboratories. The DoD-chaired Project Officers Groups (POG) will take a more active role in warhead assessment while gaining a more detailed understanding of weapon life extension procedures. At the Department level, the joint DoD/DOE Nuclear Weapons Council (NWC) will remain the official forum for resolving inter-Departmental issues between the DoD customer and the DOE supplier of nuclear weapons technology. Additional information briefings will continue to be given to the NWC for review of critical issues involving the health of the nuclear weapons stockpile.

As an example of inter-Departmental cooperation, the DoD and DOE are currently formalizing a new annual certification procedure directed by the President for stockpiled weapons. This challenging task is being led by my office with the support and concurrence of representatives of the Services, the Joint Staff, Strategic Command, DOE, and the DOE laboratories. This new process will include an annual survey of the health of the entire stockpile. It will complement the newly implemented Dual Revalidation process which requires a detailed technical analysis of individual warhead types over a two to three year period. These two new reporting processes will provide timely information on warhead safety and reliability for the NWC.

Issues and the Future

The SSMP will require continuing support from the Departments of Defense and Energy, the Congress, the Administration, and the public. The DoD and DOE must jointly establish methods to measure success of the SSMP at specific intervals. We cannot afford to wait ten to fifteen years to judge the success of the program. DOE must demonstrate the ability to produce tritium and to rebuild all weapons types in the stockpile. Warheads consumed by the surveillance process must be replaced with certified warheads without the benefit of underground nuclear testing, a major undertaking. Litigation will undoubtedly delay construction of key facilities of the future complex—as evidenced by the current situation of the Dual Axis Radiographic Hydrodynamic Test (DAHRT) facility at Los Alamos. Most importantly, opportunities must exist to attract, train, and retain world class scientists and engineers who will be the next generation of stockpile stewards. The safety and reliability of our nation's nuclear stockpile demand an experienced cadre of our nation's best.

Since the Manhattan Project, the United States has invested heavily in the development, production, deployment, and maintenance of the national nuclear deterrent. Nuclear weapons, even at significantly reduced levels, remain a core component of future national security strategy. Our DoD/DOE shared responsibility is to ensure high confidence in our nuclear deterrent without underground nuclear testing. This enduring responsibility must have the resources necessary to ensure that the stockpile remains safe and reliable, today and in the future.

Mr. Chairman, members of the committee, absent nuclear testing, the potential for erosion in stockpile confidence will undoubtedly increase with time. To maintain high confidence is a challenge that exceeds those previously faced by our stockpile stewards, but I believe we are on the right track. The President recognized this challenge in his August 11, 1995 speech and remains committed to this challenge. The people in this room and the agencies they represent must meet this daunting requirement. This concludes my statement. I will be pleased to accept your questions now or for the record.

Mr. HUNTER. Thank you, Dr. Smith.

I am going to hold my questions until the end. I want to offer to the chairman of the full committee the opportunity to ask questions. Mr. Spence, do you have any questions?

The CHAIRMAN. There are so many questions that we could ask. We have this good supply of talent, as I said earlier, down here.

But if I might, Dr. Curtis, one thing I have worried about for a long time in connection with that big question we have of long-term storage and disposition of fissile material and how to go about that, we do not have a preferred alternative suggested to us, the way I understand it. I have always wondered about reprocessing. We might call it recycling. That might be more acceptable, I guess.

For a long time, we have refused to reprocess this material. I go back to the reprocessing plant down in Barnwell that private industry was encouraged to get involved in years ago with the assurance by the government that they would be able to reprocess all this material and it was a win-win situation. I have always had it explained to me that way. It reduces the amount of the waste to a more manageable size and it gets the good from the waste to be used again. Yet we close the plant down and put it in mothballs and we refuse to reprocess.

I have never really had a good explanation as to why we did that except some vague thing about proliferation. I do not understand it. Other people in the world are doing it and I do not know how we handle that proliferation problem. The scientists and people I talked to about it in the private area wonder about it, too, so maybe you can help solve that problem for me.

Dr. CURTIS. Mr. Chairman, this debate has been part of the public consciousness for at least 15 to 20 years of my certain knowledge. Obviously, the plutonium in spent fuel has a high energy content and those who see value in reprocessing see that value in recovering that plutonium for refabrication into a mixed oxide fuel [MOX] for reutilization in power production. It also has the attribute that it would reduce some of the high radioactive content of the waste stream, although you still end up with some pretty nasty stuff that will require geological repository.

The issue is twofold. One is economics. A one-time-through fuel cycle with uranium is simply much more economic than is the reprocessing of spent fuel to recover plutonium for utilization into MOX. So to some extent, the MOX option or reprocessing option has been trumped by economics.

Second, on the proliferation concern, the process itself of reprocessing requires you to separate out the plutonium. Separated plutonium is a very dangerous weapons-capable material that requires the highest of confidence in safeguard regimes to assure that that material is not diverted to a weapons use or is not vulnerable to theft.

We believe that the risk associated with reprocessing and separating out the plutonium is not worth the policy of reprocessing and we have urged other nations indeed not to follow a reprocessing strategy for plutonium extraction from spent fuel because we believe that the nuclear danger, the risk to global security associated with that particular activity is too great to bear and should be avoided.

That is basically the debate as it sets up. Other nations have not accepted the calculus that I have just laid out, but it has been the policy of this administration to discourage reprocessing for the nonproliferation concerns. As a matter of fact, economics is also very significantly contributing to this equation in the world community right now.

The CHAIRMAN. There again, I can understand maybe the economic part of that, but from the standpoint of the waste and being able to help solve that problem, the storage of that, the long-term storage of that, we keep holding out on trying to find the best way to handle that. Would not that part of reprocessing make it easier?

Dr. CURTIS. The reprocessing would reduce the total volumes of the spent fuel and therefore it has appeal for its advocates to assert that the requirements then for ultimate geologic repository are diminished, are reduced somewhat. But you still, as I say, end up with some very nasty long-lived stuff that must be ultimately disposed of in a geologic repository. It is, like so many things, a question of degree. Again, when we measure the relative risk of proceeding in that way, we have strongly urged against the reprocessing proposal.

The CHAIRMAN. I have one final question. How do other people handle that problem when they reprocess?

Dr. CURTIS. The other nations in the world have reached different judgments on this matter. The French and the United Kingdom and the Japanese, for example, continue to pursue reprocessing strategies, and those are the primary proponents of that particular policy. Certainly, the Russian Federation would side with those nations, as well.

There are other nations, however, that in essence agree with our nonproliferation concerns or otherwise, because of the economics, have simply eschewed the reprocessing path.

Mr. HUNTER. Thank you, Mr. Chairman, and thank you for being with us today.

I would like to ask the distinguished ranking member of the full committee if he has any questions. Mr. Dellums?

Mr. DELLUMS. I have perhaps an observation and a question or so at this point and then we can come back a little later.

Dr. Hecker, I appreciated your observation near the end of your opening remarks, because as I listed to all of the witnesses' opening statements, I was indeed both struck and impressed with the evolution of the discussion even in 1 year, because as I recall, last year, there was some if not modest reluctance to totally let go of testing. We got into the discussion of whether or not science-based approach, while it raised a hurdle, would challenge people scientifically and intellectually and architecturally and engineeringly and that that could produce an exciting coming together of people to really attempt to handle these problems within a safer environment.

I am pleased that that appears to be something that is taking hold and that excitement is evolving. So my first observation is that I am appreciative of that and it seems to me that just in 1 year that part of it, it seems to me, has moved forward in a very interesting and exciting way.

If you want to comment any further than your opening remarks on that, you can at this point.

Dr. HECKER. I am sorry, what was the specific question?

Mr. DELLUMS. No, I said that if you wanted to comment any further than your brief opening observation, you can at this point. Is it indeed your observation that things have moved forward in a period of 12 months and sufficiently enough that you feel comfortable that the scientific-based approach can indeed accept both the challenge and the opportunity of dealing with the integrity of the stewardship through that approach as opposed to testing.

Dr. HECKER. The difference that you see from last year is now the decision has been made. Last year, we were hanging in limbo and we had hung in limbo since September 1992, when President Bush declared that we would observe a moratorium. We were in the limbo of, on one hand, not being able to test, but on the other hand, of our people still holding out to say, look, the best way to accomplish our job is with testing and that still is true. In the era of underground limited testing, that is the most efficient and certain way that we can take care of our job.

However, we had been sitting in limbo. The President made his decision for a number of reasons that Mr. Curtis had indicated. What I have indicated to you is that our people have made the switch to say, in the absence of testing, the science-based approach is the only way and that there is an era of excitement again in the nuclear weapons program associated with that.

However, I must state that along with that, I said in my testimony that we cannot guarantee that we can do this. That is why the safeguards that Chairman Hunter referred to are really crucial from our standpoint, and that is there may come a time when we will have to say that we could not do this job. In the meantime, the science-based approach really gives us the only avenue to get there.

Mr. DELLUMS. I would like to just ask one very specific question regarding the National Ignition Facility. As you recall, last fall the Secretary of Energy came to the conclusion that pursuing this program did not constitute a proliferation threat, and that was certainly one of my concerns, that if the National Ignition Facility [NIF] was designed to address the integrity of the stewardship of the stockpile, that is one thing.

On the other hand, we also had a larger obligation and that is to impede, if not prevent, in my opinion, new weapons development. So we wanted to look at this issue in terms of the proliferation implications. Last fall, that judgment was arrived at, and so we have moved past milestone one.

Notwithstanding that conclusion, I remain concerned that we not pursue a strategy to substitute science experiments for weapon testing which could actually provide so much capability that it would allow us to escape the intended purpose of the Comprehensive Test Ban Treaty, which, of course, I alluded to earlier, if not to impede, if not to prevent new weapons development.

Could each of you comment on this concern and tell us, in your view, whether we would approach such a threshold with this science-based stewardship program? Would you like to start, Dr. Curtis?

Dr. CURTIS. Mr. Dellums, I think it might be useful if we could start with Ms. Rohlfing because the analysis that you referred to, which was done with a peer review process, was conducted by her Office on Nonproliferation and National Security to address the issues that you raised.

Mr. DELLUMS. Thank you. Ms. Rohlfing.

Ms. ROHLFING. I realized as the question is being passed to me that I was reading something and I largely missed the question, but I gather it has to do with the nonproliferation report on the National Ignition Facility.

Dr. CURTIS. Right, the KD–1 prime.

Ms. ROHLFING. We did, in fact, conclude our KD–1 prime NIF report some months ago and concluded that the facility would not have any adverse nonproliferation impact. I do not know if it would be useful to provide additional detail on that report. We have, of course, supplied copies of the report to the committee.

Mr. DELLUMS. You could hit the highlights if you wish at that point and that would bring all the members up to speed.

Dr. CURTIS. Perhaps, Mr. Dellums, while Joan is referring to that report, it might be useful for Dr. Tarter of Lawrence Livermore, where the NIF is proposed to be sited, to address the issue, as well.

Mr. HUNTER. Yes, we want a neutral party here on this.

Dr. TARTER. I do not know how to search for that, Mr. Hunter. What I can describe about the process is that I think, as Mr. Curtis has said and Ms. Rohlfing has described, is that this was a very, very extensive process to take every aspect of a facility like the National Ignition Facility and ask the question, can you design a weapon with that? Whether that is the exact phrasing, that is basically the question you have asked.

Mr. DELLUMS. Yes.

Dr. TARTER. The answer is, you do not design a weapon with the National Ignition Facility. You do not design a weapon with other kinds of experimental facilities. I think, again, from a technical point of view, this is a reasonably straightforward conclusion. You simulate special experimental conditions that speak to parts of weapons science but you do not simulate the performance of a weapon.

So from my own point of view, it is a very straightforward thing that we are finding out things about weapons science, we are exploring special aging things, such as a crack in an existing weapon as part of what happens when weapons age. We might explore some issue about a current weapon, a part of a weapon, but we do not explore the entire weapon, which means the design, in the context of that facility or other fusion facilities like it.

So from the technical point of view, I never believed that this was a—from the point of view of a technical person, this was not a major issue. From the point of view of a policy person, I have to turn to Mr. Curtis and Ms. Rohlfing for their assessments. But simply, our people use it as a tool, an experimental tool for science, not a design tool for the whole weapon. Paul or Sig may wish to comment, too.

Mr. DELLUMS. Thank you.

Dr. ROBINSON. In my statement on pages 9 and 10, I brought up some issues with respect to that. In the negotiations of a CTBT that are going on, the question of what are permitted is on the table. I am worried that there is wider confusion on the issue of the inertial confinement fusion measurements.

The simulation devices that we have built in our laboratory for many years to look at the outputs of nuclear weapons, including the one that I described has given us by far the best output conditions, might well be treaty violations if the language of 1975 is put forward. So it is something that is in active play right now.

I would agree with Bruce Tarter. Almost any tool could be diverted for design purposes, but I cannot think of anything that would be a greater stretch than to try and take inertial confinement fusion and use that to design a weapon. The primary is the key part of the weapon and there really is almost no relation to weapon primaries from the work of any of these ICF facilities.

Mr. DELLUMS. Thank you.

Ms. ROHLFING. I can summarize some of the report recommendations, if that would be useful, or the report conclusions.

Mr. DELLUMS. Just one second. Dr. Hecker, do you think it is appropriate to respond at this point and then yield to her? You had a comment at this point?

Dr. HECKER. If I may, just to follow up on my colleagues, if you do not mind. Let me just take this into a bit broader direction, because I am very concerned the direction of your question, which has the potential of driving us to the point that, in essence, we could not do anything, do any experiments, perhaps any computations or activate our people's neurons if it has the potential of somehow helping in someone's nuclear weapons design.

Through the discussions on the CTBT, it was very clear that this was a tradeoff between nonproliferation issues and this very serious job that we have of taking care of the stockpile. I am very concerned that one does not take away those things that we require to take care of that stockpile.

At least, it was my impression that the real issue was one of not having a nuclear explosion, and particularly an underground nuclear explosion, and I thought the zero yield was specifically meant to be neither a real underground explosion nor what we defined as essentially hydronuclear experiments.

But once you go past that, and if you talk about a National Ignition Facility, if you talk about radiographic facilities or you talk about computational capabilities, you are going down the slippery slope where we will not be able to do the job that we are responsible for doing, and that is to take care of the stockpile.

So I think the current issue might be the National Ignition Facility, but the broader issue is one, either we are going to be able to take care of the stockpile or we are not. I am really concerned about losing the tools that are required to do it.

Mr. DELLUMS. Let me just briefly respond, because I think this response places all of these issues right on the table and I would like to place them in the framework that we are in.

You are testifying before a political body in a representative form of government in what we ostensibly refer to as a democracy, and people in the community have their perceptions. You are scientists and engineers and brilliant people and you understand it at a whole other level. There are everyday people out there who do not have your scientific and engineering capability, do not bring that expertise. But in the context of our society, these are people who do not want us to move further down the road toward nuclear proliferation.

You appropriately state the dilemma. It is a tradeoff between stockpile stewardship on the one hand and nonproliferation on the other and we live in a world of perceptions.

One of the things I felt good about—I do not know what the ultimate end of it will be—was that with Lawrence Livermore Lab, we did enter into a democratic process. People did come in the room where scientists and engineers and administrators and political people and arms control persons sat down in the room for the first time and closed the door and said, let us try to understand each other, and that is what this whole process is about. You have one level of awareness.

It is like administrators and boards. Administrators always say, look, we could do our job without these board members interfering with what we do. We could have a wonderful world. But that is not the world. We are also the board of directors. We also have a fiduciary responsibility to people who do not understand it the way you do.

So that creative tension of tradeoff is important, and so we have a responsibility to end that tension, to constantly challenge each other that we are not leaning to a point where one of those things gets compromised. Where that point is, none of us know. I only can hope that reasonable human beings can come to that.

We can always pose the question as you posed it in the extreme, which is if we turn on the neutrons of a brain and that brain starts to think, then we can say, gee, that is a violation of proliferation. But that is not the real world. That is not where reasonable people are. Somewhere in here is where we have to come together, and in that overlay, hopefully we can arrive at a set of policies that allayed my anxieties and my constituents' anxieties who do not want to build any more nuclear weapons and your anxieties and all of our anxieties about maintaining the integrity of this stockpile that we in our genius or lack thereof have created. That is what this whole thing is all about.

So I understand what you are saying. The tension that you bring to it is also from the other side the tension that we bring to it and there has to be an overlay that allows both of us to walk away as reasonable human beings, saying we are able to handle both. That is the intended nature of my question.

My question is not to impede your capacity to do the stockpile thing, because I live here, too. If the stockpile blows up, we get killed. We do not stand outside of that. I have just as much concern about it as you do, and for my children and my grandchildren, and so do other human beings. That is not the issue at all. The question is whether we go further out here with respect to proliferation.

That is my question, not intended to put you into a corner to not be able to do your job. That would be stupid from our standpoint. But what we are trying to do is to not allow that to happen in such a manner that we create the opportunity for greater weapons capability. We may not be able to put this genie back in the bottle, but the intellectual and political challenge is to try like hell to do it.

I realize that zero testing is not a perfect answer to proliferation. Zero testing, no proliferation. We are not stupid people. We understand that it is not perfect, but it is a tremendous help. All I have been trying to advocate is that if we take a science-based approach, there is tremendous brilliance and great genius out there, and the one thing I have learned in 25 years is wherever you put the money to stimulate people to think, they will start thinking in a very wonderful and creative and extraordinary way.

I am just saying to my colleagues, if we move it into science-based, there are some brilliant people who are going to step forward and come up with some incredibly exciting ways of trying to deal with this issue above and beyond testing and that is what I would like to see happen, so that is the nature of my question.

I was not trying to preach, but I think you laid the point right out on the table. The scientists and politicians and community people and lay people and housewives and bus drivers and school teachers and what have you, we have to all come together and agree on where this thing is going. That is all my question was really designed to do.

Ms. ROHLFING. Let me just offer a few brief summary points of the report's conclusions. It occurs to me that some of the people here may not be familiar with the National Ignition Facility and the purpose of the facility.

The National Ignition Facility, or the NIF, for short, is the next step proposed by the DOE in a progression of inertial confinement fusion facilities. We hope to reach the goal of ICS capsule ignition in the laboratory using the National Ignition Facility.

Let me speak briefly to the process for having drafted, reviewed, and concluded this report. The Office of Nonproliferation and National Security, the program that I am responsible for, was deemed to be a more independent entity within the Department to first draft this report because we do not have programmatic responsibility for the National Ignition Facility itself.

We did draft the original report on the nonproliferation implications of the NIF. It was circulated widely for public comment. We had many public meetings to address concerns and issues raised in the report and it was also then reviewed by an external panel of experts before we concluded the report.

With respect to the principal findings, there were two areas of concern and inquiry that we pursued to break them out. We looked at the implications of the NIF for vertical proliferation, and by that term I mean increases in the number of nuclear weapons or warheads or development of new types of weapons. We also looked at the implications of the NIF for horizontal proliferation, and by that I mean the spread of nuclear weapon capability to states other than the declared nuclear weapons states.

Some of the conclusions in those two areas are the following. With respect to vertical proliferation, we concluded that NIF experiments cannot—and this is just to reinforce what our lab directors have already shared with us—NIF experiments cannot provide a means of proof testing new warhead designs. We also believe that openness measures at the facility and congressional oversight will help to assure that NIF is not contributing to vertical proliferation.

With respect to horizontal proliferation, we believe that the utility of the NIF, and for that matter, any other ICF facility to other countries for the development of nuclear weapons depends upon the type of weapon being pursued, but the NIF technology lacks relevance to the development of nonboosted fission devices. It is also important to note that the kind of high-energy density information that will be available at the NIF is already being openly published by other countries, as well as the United States.

Let me just conclude by saying that the general final conclusion of the report is that the NIF supports nuclear nonproliferation objectives of the United States because it will help enable us to pursue a Comprehensive Test Ban Treaty and we also think it will help obviously maintain the cadre of expertise in physics in the United States, and by sharing the basic science applications with appropriate scientists from around the world, we will make NIF operations consistent with article 4 of the Nonproliferation Treaty.

Mr. DELLUMS. Thank you very much, and I thank all of you for your responses.

Mr. Chairman, I would just say I appreciate your generosity. Just one observation. I know that a number of my colleagues, particularly on this side of the aisle, have been very critical of the Department of Energy. Let me just say this in a nonpartisan fashion, that in terms of how this process evolved, it was an extraordinary process and it was done extremely well. It was extraordinarily open. It allowed the maximum range of participation.

So I think that if you stop and look in very specific ways at very specific sets of activities, you may find that you come to a different conclusion about the levels of competency and willingness to be open.

What is at question at this point and what is being evaluated by people outside is to look at whether or not they agree with the conclusions. But no one has challenged the integrity of the process, that it was an incredible process, diligently carried out, well staffed. I thought it was just a magnificent piece of work. What we are all looking at now are the conclusions that are driving the next level of decision, and that is appropriate, because that is what this process is all about, is give and take.

So I just lay that on the table. I think that is an important issue. I appreciate your response and I yield back my time.

Mr. HUNTER. I thank the gentleman.

The gentleman from Kentucky, Mr. Lewis, is recognized.

Mr. LEWIS. Thank you, Mr. Chairman.

Dr. Curtis, just recently, there were reports that Russia had done an underground nuclear test. I just wanted to see if you could confirm that. I think it was in mid–January, something like that.

Dr. CURTIS. Mr. Lewis, what I can say is that we do have evidence that activities occurred at a site in Russia that is consistent with activities that associated with a nuclear test, but we cannot at this time confirm whether such a test occurred or not. This matter has been briefed to the highest policy levels of our Government. As you may be aware, Secretary Perry commented on the matter in his testimony before the Congress, I think on Monday, or maybe it was last week.

Mr. LEWIS. Thank you. Where are we with the North Koreans and the treaty with them?

Dr. CURTIS. As you know, we have an agreed framework with the North Koreans which is neither an agreement nor a treaty, but it is, we hope, a measured set of actions on both parties that are designed to first remove a threat associated with the discharge of 8,000 fuel rods from a test reactor in North Korea and also achieve by their actions a closedown of their reprocessing facility.

The United States, working through a consortium called the Korean Energy Development Organization, is in the process of supplying or preparing to supply light water reactors to meet the power needs of North Korea and replace the reactor program that they had in place in North Korea. That is the broad outline.

What the Department of Energy has been engaged in is, first, stabilizing the pool in which the 8,000-rod discharge is contained at Yong Biun and then cleaning that pool, removing the accumulated silt at the bottom of the pool, and then to prepare for and begin the canning of the spent rods. All of those activities, stabilization of the pool, reducing its temperature during the summer months, and now removing the sludge that had accumulated at the bottom of the pool, that has all taken place and is complete. We are beginning the first canning of the rods. We will can the first rod in March and we expect to complete that process in this calendar year.

The pacing of this activity, of course, is particularly sensitive to the permission of the North Koreans at any given time, and therefore it makes planning and work at the site always a matter of negotiation and therefore sometimes we cannot assuredly meet schedules as if we were conducting this activity in the State of Washington or in any other environment where we would have more control.

It is essentially an 18-week process to can the full 18-rod discharge.

Mr. LEWIS. I know you have requested some more money on this. Are these problems that you were not contemplating, is that the reason for more needed funds?

Dr. CURTIS. There are two things, I think. First of all, the first filtering system that we delivered on site did not work and we had to replace that. The second thing is the timing issues, which has extended the work activity. As we all know, time is money. That is the most significant impact on it.

This is actually a success story I think we should all feel very good about. Obviously, North Korea is one of the states of greatest concern in the world community. We have proceeded in this process. The 8,000-rod discharge contains enough plutonium for three to five weapons, so that we are securing that under International Atomic Energy Agency (IAEA) safeguards and stabilizing that facility is, I think, a great achievement. That we will get it done this year, we shall all be proud of.

Ms. ROHLFING. Could I just add to that a note that we, and I do not think I shared this information with Mr. Curtis earlier because we got a fax at 6 a.m. this morning confirming that we did complete our first can yesterday. So we now have proof of that process.

Mr. LEWIS. In time for this hearing.

Ms. ROHLFING. In time for this hearing. That is also exactly right. And also, just a note. Mr. Curtis referred to some of the unanticipated challenges that we have met along the way. They fall into three categories. Of course, the time delays that he referred to. We have also had technical challenges as well as political issues to address, both with the North Koreans and with the IAEA as we negotiate with them on safeguards and measuring procedures.

For example, the sludge vacuuming system that Mr. Curtis referred to earlier did, in fact, have to be replaced in the December timeframe, the reason for that being that we were not allowed to do a detailed technical analysis of the state of the fuel rods in the pool until we actually went in on the ground in the September timeframe last year. We are encountering technical, or a situation that is unknown to any of the experts in our community of experts. There has been significant corrosion of the fuel rods, which created instead of about an inch of corrosion on the bottom of the pool that we had estimated last January on the basis of an initial visit to the site, by the time we actually got there in September, there was 6 to 8 inches of sludge.

So it is things like that that we could not have anticipated that required systems that are, again, unlike any systems we have ever had to engineer here in the United States or even in Western Europe. But as Mr. Curtis points out, we have so far met each of those challenges and expect to now begin at a more rapid pace canning the spent fuel rods.

Mr. LEWIS. Great. Thank you.

Mr. DELLUMS. Would the gentleman yield to me for just a follow-up to that question?

Mr. LEWIS. Yes.

Mr. DELLUMS. I thank the gentleman.

I would like to ask a follow-on question, and I think you raised a good question about the additional funds that are being asked for. Let me put the question slightly differently. What would be the impact, adverse or otherwise, to United States national security from your perspective by failing to provide these additional funds for controlling materials in Korea and/or the former Soviet Union?

Ms. ROHLFING. Potentially very serious impact because we would not be able to complete some of the activities that we had originally hoped to complete within the $10 million reprogramming that we requested last year and the $3.6 million that we requested for the current fiscal year.

The kinds of activities that we would envision include characterizing the spent fuel so that we will understand how to dispose of it, which is going to be one of the steps down the line after the canning is completed. Also, we are going to need to continue to monitor the canned fuel in the pools once we have completed the canning process to make sure that there are no leaks or any problems of any nature.

Dr. CURTIS. Can I offer just a broad perspective? If we do not can this fuel, then North Korea may have the excuse to reprocess it for environmental health and safety reasons. By reprocessing it, they would separate out plutonium sufficient for three to five nuclear weapons on the Korean peninsula. We have 33,000 troops in South Korea.

I think you may want to get the perspective of the Department of Defense on this, because when we originally came to this committee for this appropriation, I came in the company of then-Deputy Secretary John Deutch and representatives of the Joint Chiefs of Staff, because this is a concern very much to the security of the peninsula.

Mr. DELLUMS. Thank you. Dr. Smith.

Dr. SMITH. Mr. Chairman, I will respond very briefly. Dr. Curtis has stated the position of the Department, I think quite accurately. The seriousness with which we view the need for these funds can be seen in a letter that Secretary Perry sent to me asking me to personally review the situation in canning. I have done so and I can assure you that what Ms. Rohlfing has just said is accurate according to my own staff, who have been working on it on a daily basis.

Mr. DELLUMS. Thank you very much.

I am sorry the gentleman left. I wanted to thank him for yielding because I thought that was an important question and I think this particular piece of testimony regarding the additional funds is important to put on the record, Mr. Chairman. Thank you.

Mr. HUNTER. I thank the distinguished ranking member, and I agree with him. This is very important.

The gentleman from Missouri has reentered the room. I want to recognize the distinguished ranking member of the subcommittee, Mr. Skelton.

Mr. SKELTON. Thank you very much. Again, I thank you for calling this hearing, Mr. Chairman.

Dr. Curtis, you will recall that Congress added $106 million in the fiscal year 1996 Defense authorization bill for modernizing the four nuclear weapons production sites. How does the Department plan to allocate these funds, or has that decision yet been made?

Dr. CURTIS. The Department has made a decision for allocating the funds, a decision that we believe keeps faith to the general direction that we received from the Congress which we should point out differed between our authorizing committees and our appropriating committees. I believe it would be most appropriate to ask Dr. Reis to address basically how we went about the allocation and what our ultimate conclusions were.

Dr. REIS. As Mr. Curtis mentioned, we got two different directions on this. The authorizing committee said that that money should be split essentially equally between the four plants.

Dr. CURTIS. That is correct.

Dr. REIS. The appropriators said, you should not split it equally. You should go and look at the problems that are needed both in the plants and in the laboratories and appropriate the money or apportion the money accordingly.

What we did do to start out with, we started out by looking and said, let us start out and prorate the money as the authorizers have suggested, and then we went back and looked specifically at the jobs that needed to be done in the manufacturing area, in the work force structure area, in the enhanced surveillance area and pulled together what we felt was the best compromise between those two desires. We have a table, which I could submit for the record or I could read that to you now, if you wish.

Mr. SKELTON. Why do you not submit it for the record, but can you in layman's terms summarize the table for us?

Dr. REIS. Sure. The Kansas City plant is approximately the same amount that we are giving them, $28 million, primarily for infrastructure workload and for work on the Enhanced Surveillance Program, so that is sort of right on.

The Savannah River effort we are giving a slightly lower number but that is dominated by work on the Tritium Program because we are anxious to get going to meet our responsibilities there. That, of course, was reviewed with all of the staffs to ensure that that met the desires of the committees and all the staffs were enthusiastic about that.

We also added a small amount of money, again for the tritium, and in particular for the work on the light water reactor both for Los Alamos National Laboratory [LANL] and the Northwest Laboratories. That amounted to approximately $5 million and, of course, I should point out the Senate also recommended we put some of that money in, as well.

So the difference is the Y12 plant ended up with approximately $10 million more than the $25 million——

Mr. SKELTON. Say that again?

Dr. REIS. If you assume $25 million is about the average, we ended up with at Y12, that is in the Oak Ridge plant, they ended up with about $10 million higher and the Pantex plant ended up about $10 million lower. And again, the issue there was the specific workload that each of those plants had to manage in this fiscal year.

Mr. SKELTON. What request do you have along this same line for this coming year?

Dr. REIS. We are supporting each of the plants, in particular, obviously, we are supporting the tritium are very strongly at the Savannah River site, both in terms of the accelerated production in tritium and the support work we are doing there for the infrastructure for tritium regardless of where the dual track takes us.

In particular, each of the plants and Savannah River are participating in the Enhanced Surveillance Program, as well, and we have a full request again specifically for each of the plants. I do not have the specific number here, but they will be submitted for the record.

Mr. SKELTON. That answered my question. Thank you very much.

Dr. REIS. You are very welcome.

Mr. SKELTON. Thank you, Mr. Chairman.

Mr. HUNTER. I thank you, Mr. Skelton.

The gentleman from Texas, Mr. Thornberry, who has just been given the statistics on his plant.

Mr. THORNBERRY. I would say to the ranking member, the moral of the story is, they listen to the appropriators and they do not listen to us. That is what you can take from those numbers. It is a joke.

Dr. REIS. I should point out, we do try to listen to both, obviously, Mr. Thornberry, but, of course, I should point out that their bill was voted out first.

Mr. THORNBERRY. It could mean we trumped them since ours came later, but——

Mr. HUNTER. Give him a wire brush, Mr. Thornberry.

Mr. THORNBERRY. I would like a take a second and go back up to the top. I apologize, Dr. Curtis. I missed just a few minutes of your opening statement. But on the budget that you have submitted for weapons activities, $3.7 billion, my question really is, is that enough to do what you need to do?

What we have found this year already in our hearings is that in the defense area, the administration is bringing forward to us budgets that do not meet our needs in a number of areas. We had a hearing last week even on military personnel health care and we find severe underfunding in that area. Our chairman is, of course, the expert on how we are not meeting our needs in modernization.

I realize that some of these budgetary decisions are made at a level beyond you all. You get a certain amount of money and you have to make the most out of what you get. But part of our job also is to look at the requirements and the needs and to see whether the resources that the administration is requesting are enough to meet those needs.

My first question is, is $3.7 billion next year enough to meet our needs? Then I would like Dr. Reis to answer that question, and I understand he has previously testified that we need more like $4 billion a year to meet our stockpile stewardship and management needs. Do you have enough money?

Dr. CURTIS. Yes, Congressman Thornberry, I think that the budget that we are submitting is adequate to its purpose. We are increasing the budget authority of about a quarter of a billion dollars in this program in fiscal year 1997. At the same time, we are losing the availability of some previously available uncosted balances and we are putting in the first elements of the science-based Stockpile Stewardship Program and the dual track on tritium supply.

What we need to look at for this program is a broader continuum, to look at this program as directionally building a commitment over a 10-year period of some $40 billion to get this job done. That is the sustained bipartisan commitment and support that we are anticipating will be required in this program and this is the first step and first installment on that. But we think it is adequate to its purpose in the circumstances in which we now find ourselves.

Mr. THORNBERRY. Dr. Reis, you said $4 billion was needed. Are we short?

Dr. REIS. I think we can do the job with the $3.7 billion. I think we have made adjustments by moving some of the work that had previously not been directly related to defense programs to other parts of the Department. That goes a long way in helping. This committee was effective in pointing out some of those to us. Other committees were, as well.

I think the issue is, and what I have talked about prior, is that what one really needs is the sustainability over 10 years is approximately at $4 billion a year and we certainly have this administration's commitment to make that happen.

Mr. THORNBERRY. Are you able to tell us if we find additional resources what sorts of things could you move up or would you augment?

Dr. REIS. Did you want to comment?

Dr. CURTIS. Go ahead and answer that. I did want to make a comment if I might later on.

Dr. REIS. I think certainly what we are dealing with, Mr. Thornberry, is an area of risk. As everybody has testified here, this is not Swiss watch building. We are moving into very much of a new area and different people can have different assessments in terms of where the risk involves.

I think what is important is we have a process every year, which Dr. Smith mentioned as did Dr. Hecker, to assess that risk and come back. I think that is extraordinarily important. That is one of the major safeguards of our moving ahead in the comprehensive test ban because this is a challenge. This is not an easy job to do.

There are areas that if we did go back and relook at that in terms of where the risks are, I think we have discovered, I think, a number of opportunities that are very, very useful to us. The Enhanced Surveillance Program, which is the key towards looking forward so we do not have to go back and remanufacture a lot and that we can maintain a low rate production throughout the complex, that is the key that relates what we are doing in the laboratories to the complex. That is an area that we are beginning to understand there are opportunities.

Dr. Tarter mentioned, as did I think all of the Directors, that the thrust on computation is very powerful and we think there are some real opportunities to move ahead. We think our program gets a good start on that.

The area of tritium, we are working with dual track. We are starting that. We recognize that over time, we are going to have to start investing more in those. And again, people will argue that, well, maybe you should put more up front as opposed to let us wait a little bit longer and pull on that, appropriate to that area.

And so if you asked, is there one area or two areas, I would have to come back and get back with you in more detail because I think there are a number of areas that we could go ahead. But I think the key is, again, more in terms of picking a specific area and saying that one is shortfalled or whatever it is, to think of this in terms of the whole 10-year sustained commitment. I think that, I feel very comfortable with.

Mr. THORNBERRY. Let me ask each of the laboratories, what is your budget for your laboratory in fiscal year 1997? Is it more or less than last year, and is it enough to meet the needs that have been assigned to you or the missions that have been assigned to you?

Dr. ROBINSON. Let me start. We do not have final budgets. The list we have says that my laboratory would get what I think is a substantial reduction. I am worried on this question of risk. What changed during the last year is the job got a lot tougher for all of us and we are stepping up to try and meet that challenge.

The key part that would be affected is our core Research and Development program, and here, I think Mr. Skelton's remarks about the people, I would emphasize. The people who do this work are not just numbers of people. We get people with scientific training, advanced degrees, and after 5 or 10 years of being immersed in the technologies that are very unique, compartmented, understandably compartmented technologies, they are ready to produce.

What has been unique about the laboratories since the time of the Manhattan Project is this team research. We bring all the disciplines together to make these things reliable, to make them safe. The teams are getting very thin at my laboratories and in the other laboratories right now. I think we are suffering perhaps a little too tight in budget when the stake, as Mr. Dellums said, the bar has been moved up substantially in challenge to us to meet the obligations we have on behalf of the country.

Mr. SKELTON. Would the gentleman yield just for a quick question?

Mr. THORNBERRY. Certainly.

Mr. SKELTON. How about the young up-and-coming scientists? Are you grooming any of the youngsters as they come up?

Dr. ROBINSON. Great difficulty. With the reductions in the core weapons program, over a 5-year trend, we lost about half of the funding. It is much harder to get folks to go into a nuclear weapons program. We, this past year, had a reduction of 327 folks at our laboratory. With those kinds of reductions, it is also difficult, even if you had the funds, to bring other people into a program that is in such decline.

Mr. THORNBERRY. So what sort of cut are we talking about, Dr. Robinson, for your lab?

Dr. ROBINSON. I think the budget numbers I have looked at—and again, they are not final—are something on the order of $58 million will be less than we were the previous year.

Mr. THORNBERRY. Fifty-eight million less?

Dr. ROBINSON. Yes.

Mr. THORNBERRY. And what about Lawrence Livermore?

Dr. TARTER. I prefer not to give you an actual number. As I think Dr. Robinson said, the numbers have just been released. Ours come in a different variety of kinds, a little bit more than his do, because they come both in funds for specific projects as well as operating dollars and I really do not have those aggregated. I would like to do that for you, because the impact depends on the kinds of colors the money comes in. So I do not want to speak to that, but I would like to speak to your general question.

Mr. Curtis, I think, said something which I took as a very important statement, both in terms of budget and in terms of the program: that this year's budget represents a very significant increase over last year for the total program. I think, to refer both to his comment and that of Dr. Reis, if you ask me whether—if you could tell me that I had the 10 years at $4 billion a year as something that I could manage within, I can certainly do this year's job under the current budget allocation.

So the question of the enthusiasm of the people, which is part of your issue, I think is there. How strongly do they believe in that commitment over the 10-year period? If that commitment is a very credible one, a very strong one, then I think we can manage with this as a good first step. So that is my answer.

Let me answer your other question, which other people responded to, on where would you put the money if you had additional funds. I think there are specific needs which the Department has to decide on, things like tritium, which I cannot prioritize all of those.

Within my own laboratory, I would pick one of the issues Dr. Reis mentioned, which is Enhanced Surveillance, but the criteria I would use is very specific. I think the goal is to pick additional funds into areas that will reduce risk but in particular go toward making huge economic gains toward the future. So if we can extend the lifetime, if we are able to do the preventive maintenance which Dr. Hecker referred to, and reduce the cost of having to do hard rust belt manufacturing and make it modern and save lots of money in those years by being smart technologists, that is the kind of investment I would make now to pay off in the later years both economically and technically.

Mr. THORNBERRY. Dr. Tarter, can you tell me whether your budget is going up or down from last year, putting it all together?

Dr. TARTER. My guess is that the operating budget will be somewhat down but the total budget will be up because of the expenditures toward the initiatives. That is my best guess, and I would like to verify it.

Mr. THORNBERRY. Can you tell me what the ballpark of that total operating budget is?

Dr. TARTER. I can give you a ballpark. The total budget for total activities is $444 for this year and it is listed for the Office of Management and Budget [OMB] request as $412 for next year.

Mr. THORNBERRY. Thank you.

Dr. Hecker, how are you folks faring?

Dr. HECKER. Thank you, Representative Thornberry. Overall defense programs for Los Alamos I expect to be up slightly, although I have to add the same disclaimer that my colleagues did. We really have not worked through that since the President's budget has not been detailed.

However, the issue is one of balance between some of the new initiatives and then the base capabilities. The bottom line from our standpoint—and we have worked this with some of our colleagues in the Department of Energy—is that we think at Los Alamos there will be some serious shortcomings in our ability to get the job done, as best as we can define that now.

The areas that are of greatest concern are areas such as Enhanced Surveillance, where I think we must get the jump to start those programs now. As the military requirements have been defined somewhat more clearly in the past 6 months or so through the Stockpile Stewardship and Management Plan and as the programmatic, the environmental impact statement has gone into draft form, we think that there are a number of activities at Los Alamos that we just must support better than we are today.

They are all associated with this fact that this paradigm has changed from not testing, and we at Los Alamos sit here with a lot of systems that we are concerned about, that we must now look at differently than we ever have before. So a lot of the radiographic testing, for instance, that we can tie specifically to systems such as the B–61 bomb or the W–76 or the W–88, are really things that at this point we find a shortcoming.

As I go around and talk to my people, I see that we are not spending enough money in areas such as archiving and training the next generation of nuclear weapons designers, materials people, or engineers. And then especially at Los Alamos, we have the burden of having many nuclear facilities, and this programmatic environmental impact statement indicates that the country will be relying on Los Alamos to a large extent. I personally do not feel comfortable with the money that we are putting in for upgrades and for maintenance to be able to operate those facilities safely.

So those are the base activities. Those are the needs. I would just like to make one more comment in terms of the opportunities where I would put the money, and two have already been mentioned, I would like to add my support.

One is in the computing arena: the Accelerated Strategic Computing Initiative. Quite frankly, we know so much more today of how much farther we need to go in computing than we did a year ago, even. This program has come along to the point where I think it deserves the acceleration beyond what we had initially identified.

Then the second one is tritium, and specifically on the tritium issue, we have identified for accelerator production of tritium that the idea of using a superconducting cavity instead of a normal magnetic cavity has such great potential in the out years that we would like to accelerate the cost schedule— not increase the overall costs, but accelerate the cost schedule and so perhaps move on the order of $50 million into fiscal year 1997. Now, I realize again that those were not planned a year ago, but those would be the accelerations that we would favor. Thank you.

Mr. THORNBERRY. What is your operating budget, approximately, for 1997?

Dr. HECKER. I would have to look at my colleague's specific chart. I guess the best that it has been broken down in 1997 for Los Alamos in all defense programs—that includes Stockpile Stewardship and Management—is $553 million, approximately, for 1997, and it was on the order of $550 for 1996.

Mr. THORNBERRY. So that is a slight increase.

I think maybe each of you from the labs have mentioned discussions with the administration last year in deciding, or I take it in discussing whether or not we could have some reasonable assurance of safety in not testing. Apparently, there were a series of discussions back and forth where you all were trying to reach a conclusion.

Let me ask you this. Were there any specific budgetary numbers or percentages mentioned in those discussions where you all told them, we have to have our budgets do such and such if we are not going to test, if we are going to assure some reliability. And were there assurances made that your budgets would be adequate along the lines that you had talked about?

Dr. HECKER. I think nothing was signed on the dotted line, but in the discussions toward a zero-yield CTB and actually in the President's declaration of moving toward a zero-yield CTB, there was the indication that the support will be there to make this happen.

In the discussions we have had with Dr. Reis in looking at, let us say, 2010—the year 2010 and what it would take to get there—we had used the numbers that Dr. Reis just mentioned earlier: nominally $4 billion a year for the next 10 years or so before dropping down in the year 2010 to some lower level. That is about the level at which we had the discussion, that it would take on the order of $4 billion per year for at least 10 years.

Mr. THORNBERRY. Finally, I think I have some of the same concerns that several of you echoed or mentioned about our budget. When I look at the way it is broken down, of course, substantial funds go to some of these new projects, the National Ignition Facility and the fast computer and so forth, and I am a little concerned about what happens to the rest of the basic infrastructure. Obviously, that is a concern of the Congress or else we would not have put $106 million more into last year's budget.

What I find in my backyard, and according to your testimony, Dr. Reis, we dismantled some 1,100 odd warheads this year. We are going to be expected to dismantle 1,300 next year, and yet the money is basically level if not a little bit down. So I am concerned about whether the resources are there in order to do the job.

Let me move on, Mr. Chairman, if I may, to a second area of concern to me and that is, are we ever going to start building again? Dr. Smith had mentioned remanufacture of the primary and our capabilities there. We can maintain a static stockpile by some of the things that you are looking at now. You said an improved stockpile would be something else.

One of my questions is, why in the world would anybody want a static stockpile and want to forego any improvements? I know some of the testimony Dr. Reis gave last year indicated that our weapons are designed with about a 20-year life span. The average age is going to be 20 years by the year 2005, at which time the oldest weapons are going to be 35 years. This stuff was never built to last forever, and yet we are asking it to go longer and longer. That is one of the reasons we are spending so much money on this science.

But it seems to me at some point we are going to have to at least have the capability to build weapons again and I am not sure, based on what I know, that we can do it. I guess, Dr. Reis or Dr. Smith, either, say 2005 comes. We get tritium again. Are we going to be able to build new nuclear weapons?

Dr. SMITH. Mr. Thornberry, we do not expect that we will need an arsenal in the ensuing years from the military point of view that is significantly different than what we have right now, and one wants to remember that we have thousands of nuclear weapons right now and we will have thousands of nuclear weapons under START II. I have already said that we do not intend until START II enters into force to come down from START I. We have a very adequate arsenal to deter any sovereign power that might contemplate nuclear attack against the United States.

Now, what we do need, though, is the ability to remanufacture those weapons that finally deteriorate as time goes by, but we would remanufacture according to the designs that we now have. Those designs, of course, have been very well tested and so we, the Department of Defense, simply have to be assured that the remanufacturing capability to maintain the static arsenal will, in fact, be there when we need it.

Dr. REIS. Maybe I could comment on that, because those represent the requirements that we work to. That was the hedge-plus-lead strategy that was announced by the Department of Defense, signed by the President, and that is what we are working to.

The issue that we have come to vis-a-vis remanufacturing, because we know the individual weapon will not last forever, we have talked about all the individual parts will have to be replaced the same way you can replace the individual parts in your automobile without throwing it out and buying a new one. So, indeed, our whole program is called the Stockpile Life Extension Program. We are doing that now on some of the weapons and we are basically prepared to continue to do that indefinitely.

The remanufacturing aspect of that, of course, gets right into what the new complex is going to be, and part of our approach is to not just downsize but modernize that complex. Many of the processes that that complex used 10, 15, 20 years ago are no longer appropriate for the remanufacturing. At the same time, we have to maintain the flexibility in that, so that if we stay with START I or even if the Department of Defense, for some reason or other the world changes very, very differently and we need more, we have to have the ability to reconstitute, and we think we will have that.

We have to all do that, Mr. Thornberry, within a rational budget and we are in the process of reviewing that in detail. That information will be discussed in the public meetings during the programmatic environmental impact statement public comment period that we are entering in right now.

Mr. THORNBERRY. It does seem to me it is a little bit like the B–52 problem. You can hold them together and improve them for a while and then they can last much longer and get some part of the job done much longer than their intended life. But at some point you have to buy a B–1 or a B–2. It seems to me that this is certainly an area in which we do not want to, obviously, take chances.

Let me ask in layman's terms: briefly, is it your opinion that we already have the ultimate design of nuclear weapons, and that we cannot design a nuclear weapon that would be safer, more reliable, or would have other beneficial qualities?

Dr. HECKER. I guess I can take that right off the bat. We do not have the ultimate design. We design the nuclear weapons about as close to the edge to the performance envelope as you can, because for years the idea was to get greater and greater performance, of course, while keeping them safe, and it took the people to keep them safe.

So if you are asking, could we sometime in the future design one that is safer or more robust, that would have to be remanufactured less often, the answer is yes, indeed, we could.

I should add on the remanufacturing, I can guarantee you that we will never manufacture another weapon the way we did it prior to 1989 when Rocky Flats closed down; never. They will all be done somewhat differently, and that is why we need the partnership between the plants and the lives: to make sure we do it right.

Dr. ROBINSON. Let me comment. It is Sandia's responsibility for the electronic portion: the arming, fusing, firing. Electronics technology changes. I think the American public has the right to expect that they will have the best safety, security, and use control technology that can be provided. Regarding the analogy that was just used about a car: I do not think you would want a car today without air bags or an automatic braking system. You would not make do with a car that was there before. The public has a right to expect that. We would like to be able to deliver that.

Those are retrofits of portions of the system to refresh the stockpile but not change the basic nuclear design that was tested. Without nuclear testing, we will not be able to move away from those previous designs for the core nuclear parts.

Dr. TARTER. I have just one additional comment along the line that Dr. Hecker made. Trying to say it in layman's terms, we are going to produce when we rebuild and remanufacture, as Dr. Smith said, the same basic design of weapon, but as Dr. Hecker said, it will not be done with exactly the same parts, exactly the same pieces that were done before. So it is not reproducing the car.

I am not sure in the nuclear case the B–1 analogy is quite right. I think to some degree we will be exploring materials which replace other materials, and that is part of the stewardship program, to assess whether that can work. So I think we will be able to incorporate some degree of modernized features within the framework of the designs that exist, but they will be basically the same designs with the same military purpose. If the military purpose changed for some reason, then we are in a new world.

Mr. THORNBERRY. I appreciate it.

Mr. Chairman, I have a series of additional, more specific questions on our capacity to build nuclear weapons again which I would like to submit for the record, if that is OK. That would give our witnesses more of a chance to comment on some of the specific concerns I have.

If I could ask one last question of Dr. Reis, a lot of things are happening in the production facilities, in the labs in this new era. What is happening with the administrative part of weapons programs? Is there being similar downsizing in the personnel in Washington and other administrative offices and where do you see that going?

Dr. REIS. There certainly is a downsizing in the administrative offices, and at the same time, what we are trying to do while we are doing that downsizing is that there is a shift in the type of people we need. Frequently in the past—the whole system is changing because the job is changing. We have made particular—for example, in my office, I have brought in, as for my Deputy Assistant Secretaries, there are people who have had much more weapons experience in the past in headquarters so they can provide the type of oversight we need.

We have, for example, a group of people both from the laboratories and now from the plants as well who sit with me and give me the type of advice we need as we create this system. We are working in much closer concert with the people in the field offices in Albuquerque and Oak Ridge and Oakland and in the field offices themselves because we are definitely downsizing, but what we do not want to do is we want to ensure that the training and the background of the people who will be doing this will be appropriate to this new and challenging job.

Mr. Thornberry, I think we have discussed this several times. Almost all of the members have mentioned this, I think, this people issue. If you ask me, what is the most difficult problem that we have to face over the next year and I think perhaps the laboratory directors and I am sure the production plants, it is really maintaining that competence in those people to do that. What we have to do, and I hope you got this sense from the laboratory directors, is that stimulation of those people to ensure that those neurons work when you need them is beginning to happen.

I think, from again my personal view, over the past year, there has been a remarkable change, and I am really going to have to give the gentlemen on my right a lot of credit for in these difficult times maintaining that enthusiasm to face this new challenge over the next few years. But it is that people problem ultimately that will be necessary for us to solve this.

Mr. THORNBERRY. Mr. Chairman, other than the questions I have for the record, I appreciate your indulgence.

[The questions of Mr. Thornberry can be found on page 193.]

Mr. DELLUMS. Mr. Chairman, would you indulge me just once?

Mr. HUNTER. Yes.

Mr. DELLUMS. Following Mr. Thornberry's questions, it opens up an interesting door. Your response near the end, Dr. Reis, maintaining competence, it seems to me is a very important question. You started your questioning asking, where would you add additional funds, and I would just make these three observations.

First, with respect to maintaining the stewardship program, each tiny change in these weapons creates a new imponderable. What Dr. Robinson pointed out is that the job just got more difficult because once you go to zero testing, you are now in an era of science-based activity and we all know that if you put your money where your mouth is, you are going to produce greater participation.

So you guys are running this place now. You have the majority. You do not have to be a rocket scientist to realize that you are going to put some money in the military budget. If you are going to put some money in there, put some money in there where it makes sense to me.

First, if the hurdle just got higher and the job just got more difficult, it would seem to me that if we are committed to the integrity of the stewardship program, then you ought to be putting some more money in science-based approach. That just makes sense. You bring out the creativity and the genius and the participation of people.

Second, if our national threat assessment says that proliferation is the major threat, again, you do not have to be a brilliant rocket scientist to realize that you may get a big bang for your buck if you put some more money in nonproliferation activities.

Third, and I would just offer this as a direct challenge, Mr. Chairman. There was an interesting thing last year. We had a rather primitive level in the debate, but the issue of technology transfer, or what we euphemistically refer to as dual-use technology, you guys again, running the train, you decided in your wisdom to reduce that portion of the budget.

I would argue—I would not put these folks on the spot but I would imagine they would be willing to step up to it—that technology transfer programs actually do help them maintain the scientific base because it is in those areas of technology transfer where people again can use their brilliance and their creativity. It does not just have to come out in developing a weapon. It can also come out in enhancing the quality of human life in scientific advances that are ascertained as you move to a dual-use concept, but you guys chose to reduce those budgets.

So I would just summarize by saying, if you are going to put money in, put money in where it makes sense, on the stewardship program, science-based approach, because the hurdle is higher and the job is more difficult. Put money there rather in some of these more parochial things, weapons programs.

But second, put it in nonproliferation if you agree that that is a major threat. You guys have been talking about that every day for the last 14 months.

And finally, if you are interested in the people approach and expanding the base or maintaining the scientific base, then how can you argue rationally—or at least logically, let me not say rationally—logically that you are assisting in that when you cut technology transfer programs when it is indeed those programs that maintain your science base and provide you the opportunity to, as one of the witnesses pointed out, maybe it was Dr. Tarter, I am not sure, but your concern has to be for economic growth toward the future. Where do you expand economic growth toward the future if you do not put money in technology-based technology transfer programs? That is where you are looking into the future.

So if you are going to do it, it seems to me that those are the three areas and I think they have all commented on all three of those areas. I would just underscore it for the purposes of emphasis.

Mr. HUNTER. I thank the gentleman.

Mr. DELLUMS. I know my last point was a challenge to you, but I know you will step up to it.

Mr. HUNTER. We like to be challenged. I would say to my friend from California, we spent a great deal of our careers challenging each other and it has been one of the things that has kept us both around here, I think.

Let me just, Ron, move your question through to the witnesses, because I have the technology transfer schedule here. Our adjusted expenditure for fiscal year 1996 was $149 million. This year, there is only proposed by the administration $49 million, roughly 30 percent of what you got last year. That is a marked reduction. Does anyone want to comment on that? Dr. Curtis.

Dr. CURTIS. I think two things. First of all, Mr. Chairman, we try to be good listeners so that we have, in fact, when we have had to take measured reductions in our budget as we go through the tug and pull of trying to fit our requirements in our fiscal circumstances of today, we have, in fact, selected some reductions in the technology transfer programs in order to preserve other expenditures.

What you will not see in those figures is that some of those technology transfer programs, funding responsibility is shifting to other parts of the Department's budget, so that they, in essence, will be accommodated in other parts of the budget. A principal example would be the Partnership for the New Generation of Vehicles, a $15 million program in the defense programs budget is being consolidated with companion programs in the energy efficiency budget.

Mr. HUNTER. So you think the technology transfer programs that list at least a line item of about 30 percent of what you got last year is robust, from your perspective?

Dr. CURTIS. No, I would not say that. I think that we are obviously, as you find yourself often, trying to make relative judgments and strategies in order to get this job done. Again, let me return to the Partnership for the New Generation of Vehicles. It contributes to the weapons programs because of the advancements in materials science, a very important part of the challenge to this program. Nevertheless, that program carried in the energy efficiency budget will still flow that $15 million into the laboratories that will contribute to the core competencies that they need to bring to bear on this challenge.

Dr. REIS. Let me go back to the process by which we did that, which was similar to, as you asked before, what was the process. The discussions we had last year, as you recall, and this committee was not alone on that, was to try to sharpen up specifically those things that added the most to defense programs, even though they were dual use. So we literally went through program by program and tried to say, which are those things that are absolutely critical in looking at this and which are those things which would be more appropriately done in other parts of the Department of Energy.

Again, we went through that list very, very carefully and they will be, assuming everything gets passed the way we have submitted it, those will be funded by the same people and, of course, they will continue to work together the way they had done before. But again, I think the concern that this committee had was that it was a question of balance, and when we looked at that balance, we determined that it was more appropriate to put those in other parts of the Department.

Mr. HUNTER. Thank you. As I noted, I used to feel sorry for Ron when I would see him sitting here at the end of the hearing with a laundry list of questions that needed to be asked and no one else to ask them but him and he would go through this long list, and I need to do that.

Let me throw out one brief question to our Directors and simply kind of state the question that was posited by Mr. Thornberry and by Mr. Dellums in a different way. Simply stated, the name of the game now is stockpile stewardship. It is not design. It is not construction of new weapons. You know the great breadth and width of the nuclear weapons base, of which you are a very, very important part.

Do you think that the present size and robustness of your individual operations is justified by this different mission, and in some minds a lesser mission, this mission of maintenance, if you will? Can you keep things rolling and keep the teams together that you mentioned are thinning down with this mission, and should you?

Dr. ROBINSON. Let me start. We went through these discussions a great deal in the preparation for the President's statement in August. There were three key points in my view. First of all, the President embraced a statement that should we get a problem with the U.S. stockpile, a critical part of the U.S. stockpile that is sufficiently great, he would identify a problem with the U.S. deterrent force as a supreme national interest.

That is a critical part for me, and I think for my other colleagues, in signing up to this that really puts the word "challenge" and how the word "challenge" grew into our dialogue. Try this. See if you can find a way to maintain confidence, reliability, safety, security of U.S. nuclear weapons without underground testing. If you cannot make that, there is a fallback.

The second part was a heightened activity in trying to examine each of the weapons in the enduring stockpile and certify them each year, and that is a joint process involving DOD and the laboratories that raises the awareness, the interest in our most important assignment, which is to maintain those weapons.

The third issue was the question of funding, and I think that is a total package. I appreciate Mr. Dellums' remark. When the job is harder, it does take more funds to do that.

Mr. HUNTER. So your position is you think it may be a more robust lab system than what you had when you were actually producing weapons now that you are not producing any.

Dr. ROBINSON. I am sorry. We have already downsized the program nearly a factor of 2, Mr. Hunter, over the previous 5 years. I am not saying going back to that point, but somewhat above where we have been recently.

Mr. HUNTER. That might be helpful, too. Dr. Robinson, how many folks did you have 5 years ago in Sandia? What is the approximate number?

Dr. ROBINSON. The laboratory is a multiprogram laboratory, so if I quote you total numbers they will not match the weapons program per se. Let me supply you——

Mr. HUNTER. I understand. We have a study on the border fence in the southwest border, an analysis of the Border Patrol program done by your lab, which was an excellent analysis, I might add. We know you do other things.

Dr. ROBINSON. And the design of the security fence, I might add.

Mr. HUNTER. We have that in the bill.

Dr. ROBINSON. Right. But we have downsized substantially in the core nuclear weapons and test budget——

Mr. HUNTER. By approximately what percent?

Dr. ROBINSON. I think the number of workers, about 25 percent. We took a bigger part in the hardware, which we are buying much less hardware.

Mr. HUNTER. OK. Let me go quickly to our other directors, too, because I have a ton of questions here we need to get out on the record. Dr. Tarter.

Dr. TARTER. Paul's first comment is I think we would come back with a number which we have been downsized in the weapons program part of the laboratory about a factor of 2 from the peak during the late 1980's or early 1990's. Again, the details would not matter.

I would again pick up on what Mr. Dellums said. I think when you say the word "maintenance," that does not exactly excite the world. But replacing without testing and certifying it, that is one thing, a very difficult, very, very hard job. I think you said it as well as any of us could say it. That is a more challenging job. I would echo Dr. Hecker's comment that the enthusiasm to take that on is something which has basically rekindled a spirit of very strong commitment at our laboratory.

And so I think, yes, we need this program at least at the current level and I think you have it and if we can have that commitment, we will do it.

Mr. HUNTER. Thank you. Dr. Hecker.

Dr. HECKER. I can also echo the downsizing in the weapons core, but what you are asking me, in essence, how do I justify a $1 billion laboratory, which is what we have, in today's times? I would say it in the following way. Close to $750 million of that is associated with what Mr. Curtis called reducing the nuclear danger. It is not only in the stockpile stewardship and the stockpile management, the interfacing with the plants, but it is nuclear materials, what are we going to do with them both here and in Russia? It is a nonproliferation issue, and then how do we clean up and deal with the nuclear legacy of the past?

When you put all of those five things together, that is today an immense job. That requires science, so in addition to the $750 million, I have to have some scientific underpinning, the ability to attract the young, the best talent to the laboratory and the interface with the university and the multiprogram nature to do something in the civilian arena, again to help to underpin the technologies. They are working with industry and they are working with the universities. When you put those pieces together, that comes out around $1 billion.

Now this last year, we also took measures to cut the administrative costs because there, I think, we have the responsibility to show the taxpayer that we are giving them the best for his or her dollars.

Mr. HUNTER. Let me get into the accelerator option and the commercial light water reactor option with respect to tritium. The Department's plan calls for pursuing both and in 1998 a leader technology and a backup technology are going to be selected. You rejected the use of a privatized triple play reactor that would produce tritium, burn plutonium, and produce electricity for the local power grid. If you look at it from a layman's point of view, if you listened to the possibilities the triple play gives us and the economic mitigation, it sounds pretty darn attractive. Yet that was dismissed early on by DOE. Dr. Curtis, could you tell us why?

Dr. CURTIS. It certainly has been faithfully analyzed, in my judgment. Let me try to answer that by first focusing on the mission. The mission that is critical to the discharge of our national security responsibility is to provide a new production source of tritium.

Mr. HUNTER. If I could interrupt you for one second, at least in talking with technical people, the reactor-produced tritium is a hell of a lot more reliable from what we know now than an accelerator, which is a little bit iffy. So you are going from a known technology to an iffy technology.

Dr. CURTIS. We have not gone to either yet. We have picked a dual track, and let me explain why. The dominant mission is to produce and assuredly produce a new supply of tritium for our national security requirement. If you were going to do that in a reactor, then it was our judgment that you could more cost effectively buy a reactor rather than build a reactor. So that is the first part of the analysis.

The second is if you were to produce tritium in a reactor and add to it the disposition mission of the declared surplus plutonium, surplus to our national security requirement, could you get it done in a single reactor? A single reactor will be sufficient—a single large light water reactor, I should say, would be sufficient to meet the new tritium supply requirement, but a single reactor would not be sufficient to dispose of the estimated 50 metric tons of plutonium in the 25-year timeframe that was the policy requirement for the disposition mission. That would require two reactors of that size.

So that was one complication to the equation, but more importantly is we have not had a new reactor order in this country since 1978. If we were to order a new light water reactor for the tritium mission and the MOX disposition, we might anticipate that that would attract a fair amount of political opposition simply on the basis from those who would see it as a rebirth of the nuclear power industry options. That opposition would imperil the tritium mission.

Second, there is a nonproliferation consideration, as Chairman Spence was referring to earlier, about recognizing the energy value of plutonium and burning plutonium in a mixed oxide fuel basis. That would attract another universe of opposition, those who would oppose the new reactor that would have the tritium and MOX mission together on the basis of the nonproliferation objection to the MOX fuel load. That combines with the expected legal and environmental challenge of a new reactor being constructed at a time that we still do not have the back end of the fuel cycle closed.

Those combined concerns, namely that you have three universe of potential opposition to this mission that may impair our ability to assuredly provide the tritium supply that argued for us against mixing the tritium mission and the MOX disposition mission.

Let me be very clear. You can always add the MOX disposition mission if you make the judgment to dispose of plutonium through a MOX load in a commercial light water reactor. You could do that in existing reactors. There are many existing reactors that today have been designed for to accept MOX loads in full core or partial core configurations.

So again, you come back to the same equation. Why build a new reactor for that purpose when there are a number of existing reactors that can both meet the tritium mission and the MOX disposition mission, for that matter.

Mr. HUNTER. And the accelerator is going to cost how many billions, roughly?

Dr. CURTIS. I think the fair answer is we do not know how much the accelerator costs. We have bounded a cost estimate and the accelerator on a life-cycle cost is an expensive option but it is one that I would say——

Mr. HUNTER. Can you give me some parameters, Doctor?

Dr. CURTIS. I can if you will allow me to submit it for the record.

Mr. HUNTER. Yes, go ahead.

Dr. CURTIS. I think it runs between $4 to $12.

Mr. HUNTER. Four to $12 billion?

Dr. CURTIS. Four to $12 billion. That is life-cycle cost, anticipating a 50-year operating life of the facility.

Mr. HUNTER. That is almost enough money to be willing to trot out the lawyers and work some of the other options.

Dr. CURTIS. I think it is a great deal of money, but I think what we do hope is in the design and engineering studies underway that we can take a significant amount of the cost out of that.

Mr. HUNTER. Roughly, if you used——

Dr. CURTIS. The attractiveness of the accelerator——

Mr. HUNTER. If I could interrupt for just a second, because I have a ton of questions I want to run by you here, but if we used an existing commercial light water reactor, what are we looking at in terms of dollars from this committee?

Dr. CURTIS. It depends on whether you are purchasing the radiation services or buying the reactor itself. Purchasing the radiation services, assuming that you can overcome the legal and institutional barriers, could be a very least-cost option in the $1 billion range, I think, for the mission.

Mr. HUNTER. It could be as much as 10 times as much to do the accelerator.

Dr. CURTIS. Let me make an important point, though, because we do not know what the——

Mr. HUNTER. I know it is not that simple.

Dr. CURTIS. We do not know whether we can overcome the legal and institutional barriers to producing tritium in a commercial light water reactor. We would have to do those whether we built a new reactor or purchased an existing one or purchased radiation services. And even if we were to overcome them, they may be resurrected sometime in the future and that is why the dual track makes sense.

Mr. HUNTER. On that point, has the Nuclear Regulatory Commission expressed any opinion on this? If they have not, when can we expect them to render some kind of a judgment on this option?

Dr. CURTIS. We have been working very closely with the Nuclear Regulatory Commission and we expect to enter into a memorandum of understanding with them by which we will, in essence, explore and resolve the various technical issues that may relate to the utilization of a commercial light water reactor. I will expect that memorandum of understanding to be entered in within the next couple weeks. It has been negotiated and I believe it is ready for signature. I have myself briefed the Commission on this project, entertained their questions with technical staff.

Mr. HUNTER. Dr. Hecker, Los Alamos is developing the accelerator technology. What is the state of play?

Dr. HECKER. Let me answer that. We think the accelerator technology is not so iffy. We know how to build the accelerator. We know how to make neutrons from the protons and we know if you have the neutrons and helium 3 then we make tritium.

We have done already enough of the technological work that we feel very confident that these next 3 years that we have laid out, we should be able to answer principally the questions of the economics and also the question of time scale for the accelerator. So we will be working that jointly with the industrial folks. So technologically, we are well on the way. We have a program laid out and in 3 years' timeframe, we should be able to answer those key questions.

Mr. HUNTER. Is there anything else you want to tell us about what you are doing right now with respect to the accelerator program? How many folks do you have dedicated to this thing?

Dr. HECKER. What we have, the Department of Energy has put out for request for an industrial concern to bid on joining the accelerator project. Dr. Bishop is head of that effort here.

We at Los Alamos has several laboratories working with us to the tune of around $41 million or so in fiscal year 1996 with that heading up to the total of $85 million for next year. What we are doing specifically is developing, for instance, at Los Alamos at our LANSCE accelerator a low-energy front-end demonstration experiment. We are working very closely within the last 6 months with the people from Savannah River in looking at how does one transition that technology. It is a very close collaboration with Savannah River, with several laboratories, and the DOE is handling the procurement effort associated with bringing in industry as early as possible.

Mr. HUNTER. Thank you.

Dr. Reis, it has been reported that initially you recommended consolidating all nuclear weapons production activities at the labs and the Nevada testsite. Do you now agree that the modernize and downsize in place strategy is the appropriate strategy?

Dr. REIS. Working backward, I certainly agree the strategy we have now is the appropriate strategy. Just to get the record straight, I never recommended that we look at the——

Mr. HUNTER. That was simply rumored.

Dr. REIS. That is right. You have to be very careful about what you read in the paper, Mr. Chairman. Sometimes it is not always accurate. I do not want to shock you about that.

But what I did do, however, was ask the laboratories themselves and ask the people in Albuquerque, "what if", could you possibly do that job, what cost could you do that at, because I wanted to at least challenge the rest of the system to go back and say, well, if you can do it that cheap—or maybe we can do it even cheaper and better and more flexible. And, indeed, the work we did on the preliminary environmental impact statement, which involved, if you will, the whole team, put together a system which I believe for the total range of potential stockpiles in the future, a system that is cheaper, is more flexible, and particularly can do the job better. So I strongly concur with the current strategy.

Mr. HUNTER. How will the Department's plan, Dr. Reis, on the preferred alternative for Stockpile Stewardship and Management, how will that affect employment at the four production sites and the labs? What can we look at in terms of an employment profile?

Dr. REIS. We have some detailed numbers on that, which I will be glad to submit for the record. It is, as you might expect, a fairly complex story because what we are trying to do is consider—and they are different depending upon whether we lead or hedge, whether we maintain START I or START II. In each of those areas, however, we have also looked at even though we are downsizing the complex, as part of that, there will be continued work for that.

So generally speaking, depending upon which site—obviously, there will be a reduction at the plants. The laboratories will approximately stay about the same. They may go up a little bit because there are some additional manufacturing, particularly at Los Alamos, that would have to be done because of the closing of Rocky Flats, but I will certainly submit those numbers for the record. Just one statement is that we do not anticipate any downsizing until 1998.

[The information of Dr. Reis follows:]

EMPLOYMENT IMPACT OF DP's STOCKPILE STEWARDSHIP AND MANAGEMENT and MD's MATERIALS STORAGE AND DISPOSITION PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENTS

	TOTAL SITE EMPLOYMENT (END OF FY)					POTENTIAL IMPACTS IN 2005	
SITE	1988	1990	1992	1994	1996	DP Preferred Alt	MD Activities**
Pantex	2,627	2,390	2,673	3,230	3,348	-1,115 to -1,600	+1,450 to +2,175
Y-12	5,615	5,300	5,384	4,315	3,680	-1,480 to -1,895*	+1,575 to +2,175
Kansas City	6.946	6,414	4,489	3,289	3,563	- 355 to - 943	0
LANL	7,442	7,402	7,203	7,024	6,584	+ 275	0
LLNL	8.007	8,042	7,981	7,321	7,372	+ 267	0
Sandia	8,372	8,705	8,473	8,458	8,240	0	0
Nevada Test Site	8,035	7,713	6,670	5,468	2,989	0	+1,475 to +2,250
Savannah River	10,629	17,663	20,979	18,922	13,564	0	+1,125 to +2,175
Hanford	11,449	12,730	15,107	16,701	12,339	0	+1,250 to +2,075
Idaho	5,773	7,548	7,901	7,524	7,164	0	+1,075 to +2,125
TOTAL	**74,895**	**83,907**	**88,860**	**82,252**	**68,843**		

* Y-12 DP total does not include an estimated increase of 1300 workers for maintenance of facilities awaiting D&D. MD potential increases apply to OR reservation.

** The range of potential new jobs if all storage and disposition activities were assigned to the site.

Mr. HUNTER. DOE's plan calls for developing a capacity to produce the pits at Los Alamos. Dr. Reis, under the Department's plan, will the United States be capable of producing between 50 to 100 plutonium pits by 2003, and does the DOE budget request for fiscal year 1997 and the out years include sufficient funds to accomplish this task by 2003?

Dr. REIS. Yes, we believe it does.

Mr. HUNTER. You think it does?

Dr. REIS. Yes.

Mr. HUNTER. Dr. Reis and Dr. Hecker, why was Los Alamos chosen as a site for plutonium pit production and why was Savannah River not chosen for that mission?

Dr. REIS. Again, as part of the EIS, we looked at a wide variety of options. One, we believe Los Alamos with their TA–55 complex has the capability of producing the low-rate production that we need in the future. They have the capability. They have the expertise. They have the knowledge to meet the requirement. Savannah River does not have that at this time and you would have to reproduce that whole estimate at Savannah River.

I would add that as part of our planning process, if we ever need a much higher rate of production, our plans would be to do that at Savannah River, but at this stage, we do not see any need for that.

Mr. HUNTER. Dr. Reis, when will the United States be capable of replicating any weapon in the stockpile or rebuilding any weapon in the stockpile, and where will that take place?

Dr. REIS. We are doing that—essentially in terms of the program which we have described, we are starting to do that essentially now already. We started our stockpile life extension program with the 1987, and this is phased. As several members mentioned, we have a fairly detailed phased program so that you do not wait until all of the sudden you find yourself with a bunch of weapons that have to be replaced.

You are trying to maintain low-rate production throughout the complex throughout the weapons themselves and that is, in turn, integrated with a revalidation program, dual use, to determine when that needs to be done, and that, I should point out, is done not just by the Department of Energy but that is a joint program with the Department of Defense. They are major partners in that effort.

Mr. HUNTER. Dr. Curtis, why should not the Congress direct the transfer of the national security functions of DOE to DOD?

Dr. CURTIS. I think you have to ask your question from the standpoint of could you get the national security mission job done as well or done at all if you were to transfer it to the Department of Defense. The discharge of this mission is critically dependent upon our national laboratories. Those laboratories presumably and necessarily would go with the rest of the industrial facilities transferred to the Department of Defense. I believe that they would become suboptimalized within the Department of Defense. They would lose very much their multiprogram character, which you have heard our laboratory directors describe as essential to their ability to maintain and refresh their core competencies.

People is the critical issue. The ability to recruit, to energize, to challenge and keep scientific and engineering excellence in our laboratories is a requirement that simply needs to be served by maintaining the multipurpose character of these laboratories. You cannot do it simply by recruiting people to nuclear weapons work.

Let me give you one example. Lawrence Livermore, of course, gets less than 50 percent of its budget—I think it is 42 percent, is it, Bruce? It gets 42 percent of its budget from defense programs. More than half of its budget is coming from the Department of Energy's other programs that helps develop those multidiscipline core competencies that the laboratory depends upon to get its job done.

Mr. HUNTER. If any of the directors have any disagreement with that, I take it that seems to be reechoing some of your statements about the importance and uniqueness of your teams and your capabilities. Do you have anything to add to that?

Dr. HECKER. I would like to just underscore what Mr. Curtis said. I agree with him completely, but I have the additional comment that at least as I see the mission today, the nuclear mission, it is more than just a military stewardship. It is also the issue of nuclear materials management, nuclear materials disposition, the nonproliferation aspects and the cleaning up the legacy and the nuclear waste and the interface with civilian nuclear power and civilian nuclear materials. When you add all of those together, that is much more than a military mission and does not belong appropriately in the Department of Defense, from my standpoint.

Mr. HUNTER. Thank you.

Dr. TARTER. Just one very short example. Although, as Mr. Curtis indicated, the defense program funding at Livermore is somewhat less than half of the laboratory, but to echo Dr. Hecker's comment, we, for example, are funded by the United States Enrichment Corporation to do a great deal of work in trying to think the next source of enriched uranium for civilian power. Those technologies developed in that program are exactly the ones that have allowed us to help modernize many of the production plant options. So the multi-program character feeds into much of the nuclear mission. That would not take place as a Department of Defense laboratory in any model I have seen.

Mr. HUNTER. Ms. Rohlfing, I have a couple of questions here for you. One thing just that struck me when you showed me the examples of the salutary changes in weapons security and materials security you have effected in the Soviet Union, the impression that I would think I got and I think most members of this committee would get is maybe two things.

One, we are really happy that you are doing that, but number two, it is extremely dismaying to see the state of affairs in the Soviet Union absent specific United States participation. It looks to me like they are in total chaos, confusion, nobody cares what is happening to this material. The Soviet Union is a modern state, or Russia is a modern state that had obviously the technical capability to build these systems. The idea that they have to have an American security company come over to show them how to lock up their barn doors does not seem logical if you presume that they really want to maintain some discipline and security over their nuclear weapons materials and systems.

Are you telling us inherent in your testimony that the potential for theft and loss and proliferation and sales of dangerous material is prevalent? That is the impression that you get when you listen to your testimony.

Ms. ROHLFING. We are, of course, concerned about potential diversion of material, and in particular the potential for an insider theft of material in the former Soviet Union.

Mr. HUNTER. Are the Soviets concerned about that? I guess that is my question.

Ms. ROHLFING. Yes. The good news is, one of the things we are seeing——

Mr. HUNTER. It seems to me like the essence of your testimony is unless you come and knock on their door, they could care less.

Ms. ROHLFING. I think we are seeing as a result of our engagement a very positive trend, and that is we are helping to change the culture of security at these sites in the former Soviet Union. In the past, before the Soviet Union disintegrated, the emphasis on security was—or security was much more reliant upon things like personnel reliability and guns guards, gates, and dogs.

What we are working with the states of the former Soviet Union to change is the culture and to emphasize the importance of an accounting system for these materials so that you would be able to detect through measurements and the accounting system whether material has been diverted, as well as to upgrade the physical protection at these facilities by installing perimeter portal monitors and other measures.

Dr. ROBINSON. Mr. Hunter, if I could just add a comment, because it may, in fact, apply to your previous question. The philosophies have been different from the start. We focused very heavily on technology for security protection and not only guns, guards, and fences. Those tradeoffs are made on the other side by the Soviet military and they made the tradeoffs in another direction. Now suddenly they are in a very unstable position because they did not have the technology to step in when the loyalty of the guards came into question.

Mr. HUNTER. The impression I got is that there is a certain, I do not know what you would call it, a certain disorganization or disinterest in any type of security. I think last year we had examples of people literally walking out with material unchallenged at some of these places.

Dr. ROBINSON. I do not know if the word is disinterest. I said in the negotiation, and there is concern, but they lack the capabilities.

Let me relate it to your first question, and that is should our organization be within the Department of Defense. I think the ability to have an independent surety assessment of weapons and, most importantly, a budget to let you try new technologies so the technology is available when you need it, rather than only having people trading off armaments versus safety, which was the model within the former Soviet Union, I think that should give you pause about making a change.

Dr. HECKER. Mr. Chairman, you asked a very, very good question and I just would like to give you my quick personal response because I went there in 1992 and I was concerned about the Russian nuclear materials effort and they were concerned about their ability to safeguard. We went back in 1994, by the time we had built up enough trust and scientific collaborations to work this issue.

What we were able to do jointly, the laboratories and the Department of Energy, that is most important is to jump-start them to close their window of vulnerability as quickly as possible. There is no question that they have the technical know-how eventually to take care of their materials. However, we already have the knowledge. We had systems and we worked with the Russians to jump-start and they are much, much farther today than they would have been without us and I think that is to the best advantage of the entire world.

So I think this has been one of the things that we can point to as having made a significant difference in reducing the global nuclear danger.

Mr. HUNTER. Thank you. Did the gentleman wish to comment?

Mr. DELLUMS. If you are going to move to another area of inquiry, Mr. Chairman, it seems to me that this is the appropriate point at which to ask Ms. Rohlfing the following question. First, to the general proposition that I laid on the table about if you are going to add additional funds, then add funds in the nonproliferation area. I would appreciate your comment in that regard.

Also, very specifically as per this last colloquy, given your present budget, are there adequate funds to carry out your commitments now government-to-government that deals with protection, control, and accountability of nuclear materials? So (A) the general question, and (B) the more specific question, is your budget adequate at this point to carry out those responsibilities that have just been alluded to, the management issues of nuclear materials?

Ms. ROHLFING. As you are probably aware, we consolidated within the Department of Energy last year responsibilities for the conduct of both the government-to-government aspect of this program as well as the laboratory-to-laboratory aspect of this program. We believe, given the facilities that we currently have agreements with, that we can continue with the rapid pace of this program into fiscal year 1997. However, certainly funding is a constraining factor.

Whether in the end the $94.2 million, how much it will support adding on new facilities to this list that are yet to be agreed, we will have to work that through as the year evolves. What we would do at this point within available funds is try and shift work scope of some of the multiyear projects into future fiscal years so that we could begin work at new facilities that are not on our list of agreed facilities currently.

Mr. DELLUMS. What about responding to the general proposition of increasing in the general areas of nonproliferation? You spoke to the specific program of government-to-government and laboratory-to-laboratory and helping the Russians and Newly Independent States manage their nuclear materials. My broader question was, what about the general proposition of if you are going to add monies, add moneys into the areas of nonproliferation?

Ms. ROHLFING. We could certainly find useful ways to use more funding in a variety of nonproliferation activities. The research and development program that I described in my opening statement is one area.

Mr. DELLUMS. Thank you very much.

Thank you, Mr. Chairman.

Mr. HUNTER. Certainly. If you could provide us a list of activities that could be buttressed with additional funding, we would like to have that.

Dr. Smith, your testimony cites the need to "establish methods to measure success of the Stockpile Stewardship and Management Program at specific intervals." How and when will this be accomplished?

Dr. SMITH. The Stockpile Management Plan is, as Dr. Reis has said, a living document. It is still being developed and we are adding benchmarks and milestones——

Mr. HUNTER. It sounds like the Republican Party platform, yes, highly dynamic.

Dr. SMITH. I do not have to comment on that, do I, sir? [Laughter.]

Mr. HUNTER. Actually, I think Ron would probably enjoy your comment.

Mr. DELLUMS. Some things, you can just laugh and let them lay on the table. Silence is pregnant, you know what I mean?

Dr. SMITH. As a student, I always enjoyed it in my doctoral exam when the professors started arguing, so I am perfectly content to sit here.

There are clear and obvious benchmarks by which DOD will see that the program is proceeding according to plan. As an example, one of the key ones would be the DARHT, the dual access radiographic machine, which will be an enormous step forward in understanding how weapons work by having literally three-dimensional moving pictures.

I could cite example after example, but that would not be a good use of our time. As we continue to become ever more the smart customer, there will be benchmarks added, critical paths that we can ascertain. So I am rather confident that we will have no difficulty putting together a PER chart or a GAN chart, whatever you would like to call it, which will allow us to, in fact, track exactly how well our colleagues are maintaining the stockpile.

Mr. HUNTER. Is not DARHT being held up in court right now?

Dr. SMITH. I happen to know it is, but I would prefer to defer to Dr. Curtis.

Mr. HUNTER. Dr. Curtis.

Dr. CURTIS. Yes, Mr. Chairman, the construction of the DARHT facility was enjoined pending the completion of an environmental impact statement. That statement was completed in August. We asked the court in September to dissolve the injunction and it is still pending before the court and no action has been taken.

Mr. HUNTER. Dr. Smith, we understand that you have recommended changes in DOD's organization for nuclear matters, including enhancing the role of the Defense Nuclear Agency. What are the proposed changes and when do you propose to implement them?

Dr. SMITH. The change has already been implemented. I am very pleased to introduce to you, Mr. Chairman, Dr. Jerry Friedman, who has been running nuclear matters. Dr. Friedman will be stepping down and returning to his parent laboratory, the Sandia National Laboratory. With us also today is Mr. Fred Selleck, an SES executive from the Defense Nuclear Agency who will be stepping up to that job.

What I have done here is to recognize that, in accordance with direction from Congress, and I must say, Mr. Chairman, my own predilections, that the downsizing in the Office of the Secretary of Defense is continuing. I happen to have the privilege of overseeing the Defense Nuclear Agency, which I need not tell you is replete with the kinds of talent, experience, and data to assist the Department of Defense in its oversight of the nuclear weapons stockpile.

So the change is a very straightforward and fundamental one, namely, recognizing that the talent to do much of the work that we have been doing in the Office of the Secretary of Defense can be done at Defense Nuclear Agency [DNA] with good oversight which Mr. Selleck will provide.

Mr. HUNTER. Thank you, Dr. Smith.

Dr. Curtis and Dr. Smith, could you describe for us—and incidentally, we are getting close to the end of our laundry list here, so hang in here a little longer. I appreciate your endurance and the distinguished ranking member of the full committee and the gentleman from Texas for hanging in here with us.

Could you describe for us the new certification procedures announced by the President? When and how will they be implemented? What sort of expertise does DOD have, and in particular, STRATCOM, to help make a judgment on an annual basis as to the safety and reliability of the stockpile? Does this certification procedure also include an appraisal of the health of the Stockpile Stewardship and Management Program? Will it be a very narrow certification or a broad certification, and could you just speak to that for a minute?

Dr. CURTIS. Let me start, if I might, Mr. Chairman. The President has committed us to an annual certification process that would contemplate the President being advised by the Secretaries of Energy and Defense whether the enduring stockpile remains safe, secure, and reliable and can therefore be certified to its purposes.

Historically, we have only certified the weapons as they were introduced into the stockpile, so we are basically modifying that system to an annual certification process. The judgment of the Secretary of Defense and Energy is to be informed, in consultation with the laboratory directors and the Joint Chiefs and STRATCOM, in a completely transparent process so that both the President will have the ability to see their independent views and the Congress, for that matter, will have the ability to see their independent views.

We are at present engaged with the Department of Defense in delineating the content and process by which this dual certification is to proceed and we expect to conclude that work this August. I want to make one thing very clear here, that we are not awaiting a zero-yield Comprehensive Test Ban Treaty. We are putting this in place. It needs to be in place today and it will be put in place this summer.

Dr. Smith has been intimately involved in the deliberations on this process and I would suggest he might speak to the further part of your question.

Dr. SMITH. Mr. Chairman, Mr. Curtis's statements are right on the mark. We have already begun what the President called for in his August speech of a new annual certification process. The vehicle that we have chosen is the tried and tested one of the Nuclear Weapons Council, so that we have already initiated with each POG, one of the funnier acronyms that I have to deal with, but each POG, that is, the Project Officer Group, chaired by a DOD military official, but populated by both DOD and DOE personnel.

There is a POG for each weapon system. They will examine all aspects necessary to make a certification and they will bring that information to the standing committee. It is important to realize that the standing committee has on it the representation from STRATCOM as well as the services as well as appropriate DOE representation.

We will examine each Project Officers Group [POG's] report weapon system by weapon system and then that report will be presented to the Nuclear Weapons Council chaired by Dr. Kaminsky but with representation from DOE and Mr. Curtis and the new Vice Chairman of the Joint Chiefs of Staff, General Ralston. They will make their recommendation as a council to both the Secretaries, the Secretary of Energy and the Secretary of Defense.

We do intend to meet the deadline that Mr. Curtis mentioned. Namely, the President announced the new annual certification last August. We will be ready with a process by this coming August. I would be happy to provide further detail if it would be helpful, sir.

Mr. HUNTER. Thank you. Dr. Curtis, has the President signed yet the most recent Nuclear Weapons Stockpile Memorandum and is there anything you can tell us about its contents?

Dr. CURTIS. Yes, Mr. Chairman, the nuclear weapons stockpile memorandum was signed on Monday of this week and I cannot discuss its contents in open session. I can make the observation that it incorporates the lead and hedge strategy of the nuclear posture review and it provides a basis for our planning and program content over the next 5 years.

Mr. HUNTER. Dr. Reis, does the memorandum require a tritium supply sufficient to maintain a START I level stockpile through 2005 without tapping into the tritium reserve?

Dr. REIS. That is part of the stockpile memorandum, yes.

Mr. HUNTER. Dr. Smith, as we understand it, the Navy has a single point of contact on nuclear weapons matters, that is, the Director of Strategic Systems Programs, and has been actively involved in the decisionmaking process on nuclear issues. On the other hand, the Air Force does not have a single point of contact and has been relatively uninvolved in the process. What should we make of this state of affairs? Are there ways of improving the Air Force's oversight of and involvement in nuclear weapons matters? If so, could you please share your ideas for accomplishing this objective with us.

Dr. SMITH. The situation is straightforward. The Navy has quite properly concentrated its oversight in special projects, but the Air Force has a dual problem. That is, it has ICBM's as well as bombers. Therefore, it should come as no surprise that the Air Force has more than a single point of contact. The bombers are the purview of the Air Combat Command in Langley, VA. Its new commander will be General Holly. Then we have Space and Missile Command has oversight over the missile aspect of the force.

Nonetheless, I have encouraged the Air Force to consolidate its lines of authority and I have asked General Welch, retired General Welch, who chairs the Joint Advisory Committee, to assist the Air Force in streamlining the lines by which they oversee the care and feeding of the nuclear weapons. The Air Force is well aware of this and I am quite confident that sufficient progress will be made. But I want to emphasize that the situation today is not worrisome. It simply can be improved, in my opinion.

Mr. HUNTER. The last question goes to Ms. Rohlfing. Ms. Rohlfing, press reports indicate that the administration is preparing to approve export licenses for supercomputers to the two main nuclear weapons research laboratories in Russia, Arzauras-16 and Chelyabinsk-70. The reports state that the computers would be used for environmental monitoring of groundwater pollution. However, these computers could also be used to advance Russian nuclear weapons design. So, one, have export license applications been submitted for the computers to Arzauras-16 and Chelyabinsk-70?

Ms. ROHLFING. The DOE has given its approval for those export licenses with the understanding that there would be certain restrictions and conditions placed on the license. I am not sure and will need to take for the record. I do not know whether the administration has total closure on that pending license at this point in time.

Mr. HUNTER. Could you determine what those circumstances are and please get that back to me and to the ranking member of the full committee and the chairman of the full committee? I think this is kind of an important issue.

Ms. ROHLFING. I would be happy to.

Mr. HUNTER. Who in the administration is reviewing the applications and putting those together?

Ms. ROHLFING. The Commerce Department and the State Department have responsibility, as well.

Mr. HUNTER. Who is leading?

Ms. ROHLFING. They are the approving authorities.

Mr. HUNTER. Commerce is the approving authority?

Ms. ROHLFING. With State.

Mr. HUNTER. With consultation from State?

Ms. ROHLFING. Correct.

Mr. HUNTER. If these applications were to be approved, what measures would the administration take to ensure that the computers would not be diverted to weapons work?

Ms. ROHLFING. I think there are a number of measures that the administration would be prepared to undertake and I would like to outline those for you in detail, as well, for the record.

[The information of Ms. Rohlfing follows:]

PROPOSED EXPORT OF HIGH PERFORMANCE COMPUTERS TO RUSSIA

Should the Administration approve the export of high performance computers to Russia, a set of conditions would be applied, including those listed in Section 778.3 of the Export Administration Regulations (EAR) regarding no nuclear end use and no retranfer without explicit U.S. Government approval. Additionally, there is a variety of safeguard options available, including those enumerated in Section 776.11 of the EAR. This would include the acceptance of a management and operating structure responsible for oversight and implementation of safeguards (e.g., physical protection, monitoring usage logs, limiting access to source code, and approval of passwords.) All of the above measures are currently under view.

Mr. HUNTER. I have several questions regarding that situation, but I think what we need to get is a thorough report from you to the ranking member and the chairman of the full committee and to myself, if you could, and to Mr. Skelton, also. That is of some concern to us.

Ms. Rohlfing and gentlemen, thank you for another marathon session. We appreciate you spending so much time with us. These issues are very critical issues and of great importance.

Because we have a shortened schedule, incidentally, we need to get our answers for the questions we have submitted for the record fairly quickly, as soon as possible, but Mr. Chris Williams here will work with you.

Thanks to Mr. Dellums for sticking here through the whole time, and Mr. Thornberry, thank you.

The subcommittee is adjourned.

[Whereupon, at 1:21 p.m., the subcommittee was adjourned.]

[The following material was submitted for the record:]

QUESTION FROM REPRESENTATIVE HUNTER

Fiscal Year 1997 Budget Request Highlights

Question	Dr. Curtis, please provide a brief overview of what you see as the highest priority projects included in the President's FY 1997 budget request and why these projects merit Congressional support.
Answer	I believe the highest priority projects included in the President's FY 1997 budget request for DOE National Security program are a new source of tritium, the Accelerated Strategic Computing Initiative (ASCI), the National Ignition Facility (NIF), and the core Stockpile Stewardship and Management programs.

These programs support the following list of activities and initiatives which the Department views as a suite of investments that, when coupled with their expected returns for the Nation, merit strong Congressional support.

Investments	Returns
Stockpile Stewardship & Management	Enables Signature of CTBT/ Maintain Deterrent
Weapon Dismantlements	Meet Arms Control Commitments (START I; START II)
New Source of Tritium	Maintain Deterrent
Enhanced Stockpile Surveillance Weapon Life Extensions	Support Enduring Stockpile
Downsized Complex	Create Modern, Safe, and Cost Effective Complex

QUESTION FROM REPRESENTATIVE HUNTER

Plans for Expending Fiscal Year 1996 Stockpile Management Funds

Question	Dr. Curtis. Congress added $106 million in the FY96 Defense Authorization bill for modernizing the four nuclear weapons production sites (Savannah River, Pantex, Oak Ridge, and Kansas City). How does the Department plan to allocate these funds, and why?
Answer	The Department plans to allocate the funds in the following manner:

$ in Millions

Site	Enhanced Surveillance	Programmatic Environmental Impact Statement Conceptual Design Report	Tritium	Infrastructure/ Workload	Total
Kansas City	$3.7	$1.1		$23.2	$28.0
Savannah River Site	1.0		20.1		21.1
Y-12 Plant	3.5	1.5		30.0	35.0
Pantex Plant	3.3	0.7		13.0	17.0
INEL			2.9		2.9
PNL			2.0		2.0
Total	$11.5	$3.3	$25.0	$66.2	$106.0

The Department agrees with the FY 1996 Energy and Water Development appropriation language that states that it is premature to initiate long-term capital improvements in advance of the outcome of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement process currently underway and has chosen to allocate the congressionally added $106 million to the highest priority unfunded activities within the Stockpile Management program. This allocation is consistent with congressional direction.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Restarting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question	Dr. Curtis, how did the Department arrive at this decision?
Answer	The Department's decision to pursue the dual-path strategy was based on several years of analysis beginning with the New Production Reactor Program in 1989 and culminating with a Record of Decision published in December 1995. Major inputs to the Record of Decision included the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* and the *Technical Reference Report for Tritium Supply and Recycling*, both of which were provided to the Congress Further, the analysis in the technical reference report took into account an independent assessment by a respected private consulting firm of the estimated costs of the various tritium supply options. The decision process included consideration of a broad range of categories of potential environmental impacts; technical issues and risks (production assurance); schedules and associated uncertainties; programmatic considerations; and cost estimates and associated uncertainties.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Restarting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected. DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question	What are the cost estimates and what are the technical risks associated with each option?
Answer	Several different methods were used to develop ranges of potential costs for each alternative depending on levels of confidence. Generally, there was very low confidence that costs could be contained within the low ends of the costs ranges and very high confidence that each alternative could be accomplished within the bounds of the high end of the cost range. The low, mean, and high end of the total life cycle cost ranges for each of the dual-path candidates are shown below:

Candidate	Low End	Mean	High End
Accelerator Production of Tritium	$3.6B	$5.1B	$7.8B
Purchase of Existing Reactor	$(0.8)B	$1.4B	$3.8B
Purchase Partially Complete Reactor	$0.1B	$2.0B	$4.4B
Purchase Irradiation Services	$0.8B	$1.2B	$1.7B

The above life cycle cost estimates shown are in FY 1995 dollars, discounted at 4.9 percent per year. In the case where DOE purchases an existing or partially completed commercial reactor, revenues from the sale of electricity are included. This results in a negative cost at the low end if DOE purchases an existing reactor. One of the prime objectives of the dual-path strategy is to refine the cost estimates for each approach before making a final selection decision.

The degree of technical risk associated with the accelerator and the commercial reactor options are very different. Under the dual-path strategy these risks will be closely examined and, where possible, completely resolved before a final selection decision is made in late 1998.

For the accelerator, technical uncertainties center on the need to demonstrate that the individual components of the system can be integrated into a production facility capable of continuous operation. Thus during the next three years, the Department will design, build, and test critical components of the accelerator system. The results of these tests will be important inputs to the final selection decision.

For the three commercial reactor options, tritium-producing targets will undergo a series of tests to confirm results from prior tests; increase confidence in the target for potential host utilities; and obtain Nuclear Regulatory Commission approval for their use in commercial reactors on a production scale.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Restarting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected. DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid

Question Dr. Curtis, what are the legal and regulatory actions issues associated with using an existing commercial light water reactor for this mission?

Answer The Department's examination of the commercial reactor option to date suggests that there is no legal prohibition, either in statute or treaty, on the production of tritium in a commercial reactor. However, there are several issues that should be addressed concerning the commercial reactor option. In addition, Section 57(e.) of the Atomic Energy Act contains language which, while clearly not so intended, might be interpreted as preventing tritium production in a commercial reactor. Further, should the Department purchase a reactor and choose to or be required to retain an NRC operating license, the Atomic Energy Act would need to be amended to permit the Department to hold an NRC license for this purpose. The Department is considering submitting a legislative package to the Congress to address these issues.

While there appear to be no statutory, treaty or formal policy prohibitions on the production of tritium in a commercial reactor, there are bilateral agreements between the United States and Canada, Australia and Euratom, referenced in fuel contracts with utility companies, prohibiting the military use of uranium sold by those nations to United States utilities. Since all but two reactors in this country currently use uranium fuel made from foreign uranium, U.S. reactors that produce tritium to support the stockpile will probably have to use U.S.-origin fuel, which is higher in price than foreign fuel, and for which the Department will likely have to pay the incremental cost over the foreign uranium now in use.

The regulatory issues associated with the commercial reactor option depend upon which course of action is pursued. For example, if irradiation services are sought by the Department, the utility or utilities involved would need amendments to their operating license(s) to permit tritium targets to be placed in the reactor in place of current burnable poison rods. Should the Department choose to purchase a reactor, regulatory issues related to transfer of the operating license to the Department, as well as the operating license amendment issues, would probably be involved. The use of an uncompleted reactor would add additional issues associated with the need to complete construction and obtain an initial operating license.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Restarting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid

Question — What is the Department doing to address these issues? Has the Nuclear Regulatory Commission expressed an opinion of this subject? If not, when will they render a judgement on this option?

Answer — Based upon the design and development work that has been done thus far on the tritium target, the Department believes that the technical issues associated with the target itself are straightforward. In this regard, the staffs of the Department and the Nuclear Regulatory Commission (NRC) have drafted a Memorandum of Understanding (MOU) that will guide interagency interaction regarding target qualification activities The MOU will be ready for signature by Secretary O'Leary and Chairman Jackson shortly Over the next two years, the Department will be preparing a topical report addressing technical and safety issues associated with the target design. This report will be submitted to the NRC for its technical review, and will be intended to assist in securing NRC acceptance of the target for use in commercial reactors

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected. DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question	Dr. Curtis, does the Department see any nonproliferation or other concerns with mixing national security and commercial activities at an existing reactor site or sites? If so, what are they and how will they be addressed?
Answer	Concerns about the use of civilian reactors for a military purpose have been raised in the past in the context of proliferation issues associated with special nuclear material, i.e plutonium and highly enriched uranium. There are no such proliferation issues associated with tritium, which is available commercially in the international marketplace and used for a variety of purposes from runway lights to medical uses. Tritium cannot, by itself, be used to make nuclear weapons Nevertheless, concerns about the use of commercial reactors to make tritium continue to be expressed by some stakeholders, and action by the Congress to address this issue would be appropriate The Department intends to submit a legislative package to the Congress for this purpose.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question Dr. Curtis, what is the date by which a new tritium source is required? Is this date reflected in the Nuclear Weapons Stockpile Memorandum?

Answer Under the "lead and hedge" strategy created in the Nuclear Posture Review, new tritium production may be required as late as FY 2011 (lead) or as early as FY 2005 (hedge) These dates, which will be reviewed annually, are reflected in the Nuclear Weapons Stockpile Memorandum.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected. DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question Dr. Curtis, why did the Department reject the so-called "triple play" reactor option?

Answer A "triple-play" reactor is one that can simultaneously produce electrical power, produce tritium, and "burn" excess plutonium. The Department's analyses have indicated that burning plutonium/uranium (mixed-oxide) fuel is technically feasible, and all existing commercial reactors are capable of performing a triple-play role. Thus, the Department has not rejected the triple-play concept. Indeed, the Department recently sought expressions of interest by U.S. utilities in tritium production and the use of mixed-oxide fuel, either separately or together in the same reactor, i.e. triple play. Eleven utility companies expressed interest in both missions.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid

Question	Did the Department consider the impact of electricity generation that would be needed to power an accelerator in its analysis of the options for producing tritium? If not, why not?
Answer	The Department did consider both the cost and environmental impacts of the electrical power demand of the accelerator alternative in making its decision to pursue this option. The tritium supply and recycling programmatic environmental impact statement assessed potential environmental impacts of generating the power necessary to operate the accelerator. The costs of power consumption by the accelerator were addressed in the Department's technical reference report, which took into account the independent analysis of the costs of the various alternatives prepared by a respected private consulting firm

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question	Does the Department believe that a new, privatized multipurpose reactor on a government site can be cost-competitive with existing reactors? Why or why not?
Answer	The overall benefits to the government of private instead of public ownership of a multipurpose reactor would depend on the specifics of the proposed arrangement (i e. variations in discount rate, cost of money, required rate of return, Federal guarantee requirements). The Department's analyses indicate that private ownership of a new multipurpose reactor could cost the government more in terms of net present value (life cycle costs) than government ownership, although the initial capital investment would be less for private ownership.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question Dr. Curtis, please list for us some of the candidate sites for the commercial light water reactor method of producing tritium? Does the Department prefer any one site or sites more than the others? Which ones, and why?

Answer There are no firmly identified candidate sites as yet for the commercial reactor option Such sites can only be identified after interested utility companies submit formal proposals to sell a reactor(s) or irradiation services to the Department for tritium production However, it should be noted that the Department recently received thirteen preliminary expressions of interest from utility companies with varying degrees of interest in tritium production. The attached table lists those utilities and the nuclear power plants suggested as potential tritium supply candidates It must be emphasized that the utilities identified on the attached list may choose in the future not to submit formal proposals, and other utilities that are not on the list may later respond to a formal request for proposals The Department has no preferred location(s) at this time for a commercial reactor(s) to make tritium.

UTILITIES EXPRESSING INTEREST IN TRITIUM PRODUCTION

UTILITY	NUCLEAR POWER PLANT
Arizona Public Services Company	Palo Verde Unit 1 Palo Verde Unit 2 Palo Verde Unit 3
Centerior Energy	Perry Unit 2
Florida Power and Light Company	St. Lucie Unit 2
Georgia Power Company	Alvin W. Vogtle Unit 1 Alvin W. Vogtle Unit 2
Houston Lighting and Power Company	South Texas Project Unit 1 South Texas Project Unit 2
Illinois Power Company	Clinton Power Station
Niagara Mohawk Power Company	Nine Mile Point Unit 1 Nine Mile Point Unit 2
North Carolina Municipal Power Agency Number 1 and Piedmont Municipal Power Agency	Catawba Unit 2
South Carolina Gas & Electric Company	Virgil C. Sumner
Tennessee Valley Authority	Bellafonte Unit 1 Bellafonte Unit 2
Virginia Power	North Anna Unit 1 North Anna Unit 2 Surry Unit 1 Surry Unit 2
Wisconsin Public Service Company	Kewaunee
Washington Public Power Supply System	WNP-1

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Re-starting Tritium Production

The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected DOE rejected the use of a privatized, multipurpose (or "triple play") reactor that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Question	Dr. Curtis, the Department has chosen Savannah River as the site for any *new* tritium production facility. When will Savannah River be given program management responsibility for the tritium production mission? Will it happen in FY 96, as we were told by DOE last year? If not, why not?
Answer	In December 1995, following issuance of the Record of Decision announcing the dual-track tritium supply strategy, the Secretary established the Tritium Project Office under the direction of Major General Eldon Joersz. This Office has been assigned program management responsibility for both the commercial reactor and accelerator options Separate headquarters offices have been established within the Tritium Project Office to manage each of these programs. For the accelerator program, there has also been a project management office established at the Albuquerque Operations Office. Both the accelerator and commercial reactor projects have been organized as team efforts involving the appropriate national laboratories and the Savannah River Site. Because substantial laboratory work is required on design and development of the accelerator and the new light water target extraction capability, lead responsibility for these efforts has been appropriately assigned to Los Alamos National Laboratory for the accelerator and Pacific Northwest National Laboratory (PNL) for extraction capability development. Personnel from the Savannah River Site will be working closely with laboratory personnel on these efforts. Indeed, the Deputy Project Manager for the accelerator activities at the Albuquerque Operations Office is a Savannah River Site employee detailed to that position. In addition, for the commercial light water project, Savannah River Site personnel will be supporting PNL in target technology and

fabrication, as well as utility interface activities, and the Idaho National Engineering Laboratory in development of target transportation requirements.

Lead responsibility for each of these activities will transition from the laboratories to the Savannah River Site at appropriate times. When those transition points are reached, roles will be reversed, and the laboratories will fulfill support roles to Savannah River Site personnel. Regardless of which technology is selected as the long-term supply option, Savannah River Site will have operational responsibility for the Department's tritium program.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship

Question	Dr. Curtis, please describe the Department's "preferred alternative" for accomplishing the Stockpile Stewardship and Management missions. What role does the Department envisage for the four nuclear production sites (Savannah River, Pantex, Oak Ridge, and Kansas City)? For the three laboratories? How did DOE arrive at this decision?
Answer	The Department's preferred alternative for Stockpile Management proposes to downsize-in-place the following activities at the industrial sites: weapons assembly/disassembly at Pantex; non-nuclear component fabrication at the Kansas City plant, weapons secondary and case component fabrication at Oak Ridge (Y-12). A small pit component fabrication capacity would be reestablished at Los Alamos Savannah River would continue its role with the tritium function. At this time, no preferred alternative exists for weapons high explosive component fabrication For major stockpile management functions, downsizing has a number of advantages, compared to the other options analyzed. First, it is the most cost-effective solution. Second, it lowers technical risk and provides needed flexibility to support potential variances in stockpile size under START I or START II. Third, the approach minimizes the socioeconomic impact on the workers and communities surrounding the facilities; no corresponding reductions in force would occur until at least the end of 1998. A more complete description of the Department's stockpile stewardship and management preferred alternatives, the rationale for their selection, and the resulting impacts at each weapons complex site, are described in the attached draft Stockpile Management Preferred Alternatives Report.

The preferred alternative for stockpile stewardship is to retain the three weapon laboratories, to add new experimental capabilities (specifically the National Ignition Facility at LLNL, the Atlas Facility at LANL, and the Contained Firing Facility at LLNL at this time), and to maintain readiness to resume testing at the Nevada Test Site.

QUESTION FROM REPRESENTATIVE HUNTER

Transferring DOE National Security Functions to DOD

Last year some in Congress proposed to abolish DOE, in light of significant budget reductions and reported mismanagement of the Department by the Secretary of Energy. Although the Department ultimately was not abolished, there was discussion about whether or how the DOE's nuclear missions could be absorbed by the Department of Defense (DOD).

Question Dr. Curtis, why shouldn't the Congress direct the transfer of the national security functions of the Department of Energy to the Department of Defense?

Answer Several independent studies over the past decade have indicated that, while coordination activities could and should be strengthened, the basic independence between the Departments of Defense and Energy in the nuclear weapons program should be preserved As we enter a new era without the empirical benefits of underground testing where major decisions affecting our national security may be based upon knowledgeable, but necessarily independent, judgements, the need for true independence in this process may be more necessary than before to assure the best process for national decision making

The Department of Energy (DOE), its laboratories and contractors are the preeminent authorities in this country regarding the production of nuclear weapons and the associated materials. The horizontal integration of the nuclear weapon activities within DOE and its "cradle-to-grave" responsibilities for nuclear weapons results in a commitment, continuity, and management flexibility important to program success

The inherent civilian role in, and control of, nuclear weapons must not be diminished DOE's role in maintaining the nuclear weapons complex must continue to preserve the civilian stewardship and oversight necessary for a safe, secret, and reliable nuclear deterrent. Transferring national security functions to the Department of Defense without careful consideration of its implications, scope of functions involved, and past expert reviews, would be premature It should also be noted that Secretary of Defense William

Perry, in a March 29, 1995, letter to the Chairman of the Senate Armed Services Committee, expressed his opposition to the transfer of nuclear weapons functions from DOE to DoD. The Department of Energy agrees with this position

QUESTION FROM REPRESENTATIVE HUNTER

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

On August 11, 1995, President Clinton announced a decision to pursue a "zero yield" CTBT, and stated the "maintenance of a safe and reliable nuclear stockpile to a be a supreme national interest of the United States " He also called for a new certification procedure, involving the Secretaries of Energy and Defense, the directors of the weapons laboratories and the commander-in-chief, U.S strategic Command. Finally, he established specific, additional safeguards that define conditions under which the U.S. could enter into a CTBT.

Question Drs. Curtis and Smith, please describe for us the new certification procedures announced by the President. When and how will they be implemented? What sort of experience does the DOD have, and in particular does STRATCOM have, to help make a judgement on an annual basis as to the safety and reliability of the nuclear stockpile? Does this certification procedure also include an appraisal of the health of the stockpile stewardship and management program? If not, why not?

Answer On August 11, 1995, the President directed the establishment of a new annual reporting and certification requirement that will ensure our nuclear weapons remain safe and reliable under a Comprehensive Test Ban Treaty. The Administration is currently developing the certification criteria and procedures. It will be a broad-based review of ongoing efforts and existing documentation. All active and inactive weapons will be considered by the responsible DOE national laboratories and the DOD led joint weapons system Project Officers Group. Once the new procedures are in place, the first annual certification report will be prepared. It is expected that the first report will be available in the fall of 1996.

The DOD, and STRATCOM in particular, are the users of nuclear weapons. If the annual certification procedures identify changes in warhead performance characteristics, the user of the warhead must evaluate those changes to determine if they will have a significant impact on the reliability of the system and therefore warrant an underground test to address them.

The certification procedure will not include an appraisal of the health of the stockpile stewardship and management program. The Department of Energy and Department of

Defense annually review the stockpile stewardship and management program and identify accomplishments, near term plans, and issues in a report for the President.

QUESTION FROM REPRESENTATIVE HUNTER

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

On August 11, 1995, President Clinton announced a decision to pursue a "zero yield" CTBT, and stated the "maintenance of a safe and reliable nuclear stockpile to a be a supreme national interest of the United States." He also called for a new certification procedure, involving the Secretaries of Energy and Defense, the directors of the weapons laboratories and the commander-in-chief, U.S. strategic Command Finally, he established specific, additional safeguards that define conditions under which the U.S. could enter into a CTBT.

Question Drs. Smith and Curtis, how can we be sure that the Secretaries of Defense and Energy will feel free to announce that there is a problem with the stockpile, if that announcement also means the U.S. will be forced to withdraw from an international treaty? Won't there be tremendous pressures to find "work-arounds" or sweep problems under the rug so as to avoid having to invoke the "supreme national interests" clause in the CTBT and withdraw from it? Why or why not?

Answer The Secretary of Energy and the Secretary of Defense will be advised by the nuclear weapons laboratories, the Nuclear Weapons Committee and the STRATCOM on the final recommendation they should take to the President. The Secretaries will not be inhibited from giving their best recommendation since that recommendation and all detailed information on the safety and reliability of the stockpile will remain secret. Any decision on actions to take, regarding our commitments under a CTBT, will be made by the President.

QUESTION FROM REPRESENTATIVE HUNTER

DOE's Fissile Materials Long-Term Storage and Disposition Plan

DOE's plan identifies three long-term storage options for plutonium and highly-enriched uranium (HEU): upgrade at multiple sites; consolidation of plutonium at a single site; and co-location of plutonium and HEU. The six candidate storage sites are Hanford Site; Idaho National Engineering Laboratory; Nevada Test Site; Oak Ridge Reservation; and Pantex Plant; and Savannah River Site. Plutonium disposition alternatives identified include: immobilization (glass and/or ceramic forms); reactor burn up (mixed oxide fuel); and deep borehole (directly or immobilized forms).

Question Dr. Curtis, we understand that DOE is considering a so-called "double play" reactor that would burn plutonium and produce electricity. If a multipurpose reactor is an acceptable alternative for fissile materials disposition, then why was it rejected for the tritium production mission?

Answer The Department has not rejected the concept of a multipurpose reactor which could make tritium and "burn" excess plutonium. The Department has said only that, for the tritium mission, there are a number of existing reactors that can meet the nation's tritium requirements at a much lesser cost and with fewer environmental impacts than would the construction of a new reactor. Thus, there is no compelling reason to build a new reactor The same commercial reactor(s) that could make tritium and generate electricity could also burn excess plutonium in the form of mixed oxide fuel and generate electricity. It should also be noted, that no decision has been made regarding the technology to be used to dispose of plutonium. This decision is scheduled for late CY 1996.

QUESTION FROM REPRESENTATIVE HUNTER

Nuclear Weapons Stockpile Memorandum (NWSM)

Question Dr. Curtis, has the President signed yet the most recent Nuclear Weapons Stockpile Memorandum? What can you tell us about its contents?

Answer Yes. The Nuclear Weapons Stockpile Memorandum (NWSM) was forwarded to the President on January 5, 1996. On March 11, 1996, the President signed a Presidential Decision Directive (PDD) which implements the NWSM now called the Nuclear Weapons Stockpile Plan (NWSP). The NWSP and PDD are classified but the major thrust of the two documents is the number and types of weapons to be maintained consistent with the "lead" and "hedge" policies of the Nuclear Posture Review. This provides the Department of Energy with tritium as well as other component request The United States wants to work towards START II and lead Russia to accepting START II treaty. The "hedge" part is to return to START I level if Russia does not accept START II

QUESTION FROM REPRESENTATIVE HUNTER

Nuclear Weapons Stockpile Memorandum (NWSM)

Question Dr. Curtis, why has it taken so long to gain agreement and a Presidential signature on the Memorandum?

Answer When the Nuclear Posture Review became the priority, the efforts on the Nuclear Weapons Stockpile Memorandum stopped. All efforts were directed in preparation of the Nuclear Posture Review which took several months. When the Departments of Defense and Energy again focused on The Nuclear Weapons Stockpile Memorandum, several months were required to clarify tritium requirements based on the "lead" and "hedge" strategy Agreement was reached in consultation with the National Security Council.

QUESTION FROM REPRESENTATIVE THORNBERRY

Pantex Budget

Question [To Curtis and Reis] In FY96, the Department of Energy requested a weapons activities budget for Pantex of $240 million. The actual budget has since been reduced to $235.8 million. The weapons activities mission requirements for Pantex during FY97 and FY98 increase, such as continued dismantlement and new enhanced surveillance activities, yet projected budget numbers are much lower ($17 million short in FY97 and $28 million in FY98). Is this correct? Please explain the difference?

Answer You are correct that the Department's FY 1996 Congressional Budget Request for Weapons Activities for the Pantex Plant was $240 million. This amount was subsequently reduced by $4.2 million to $235.8 million to reflect savings at Pantex, from improved efficiencies, in line with the Weapons Activities' bottom line $37.2 million contractor streamlining savings noted in the FY 1996 Energy and Water Development Appropriations Bill. The same workload will be done at a lower cost because of streamlining efficiencies that were achieved across the complex. This savings of about two percent of operating costs is a fraction of the 15 to 25% savings that typically result from similar streamlining activities in the private sector. The FY 1996 Energy and Water Bill also provided a one time increase of $106 million for maintaining infrastructure, capabilities, and enhanced surveillance. The Pantex allocation of the $106 million is $16.9 million for a final FY 1996 budget of $252.7 million. The FY 1997 request for Pantex is $244 million which is considered appropriate for the projected workload level. Since the Department's FY 1998 budget cycle is just beginning there is no known funding shortfall of $28 million in FY 1998 for Pantex.

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question	What are the pit manufacturing limitations the DOE has suffered due to the shutdown of the Rocky Flats Plant and the transfer of that function to the Los Alamos National Lab (LANL)?
Answer	There has been no significant effect on the U.S. stockpile due to the shutdown of the Rocky Flats Plant plutonium operations, as the shutdown coincided with national decisions to stop ongoing new weapon production. Since the closure of Rocky Flats, the pit surveillance mission and associated technology and records have been relocated to Los Alamos to support continued stockpile safety and reliability. A capability to rebuild pits consumed in surveillance testing will be operational within the next two years

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things) Have we done this? I believe a number of areas need to be examined, including the following

Question What are the neutron generator manufacturing limitations the DOE has suffered due to the shutdown of the Pinellas Plant and the transfer of those functions to the Sandia National Laboratory (SNL)?

Answer Prior to the shutdown of Pinellas, the DOE pre-built enough neutron generators to cover the time period needed to reestablish the manufacturing capabilities at SNL; therefore, there have been no impacts to deliveries of neutron generators Furthermore, SNL has met their requirement to assemble and recertify parts for W76 neutron generators beginning in April 1995.

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question	What are the main charge detonator manufacturing limitations the DOE has suffered due to the shutdown of the Mound Plant and the transfer of those functions to LANL?
Answer	The DOE has not suffered any manufacturing limitations in main charge detonators. Detonators were pre-built at Mound prior to its shutdown and LANL is currently establishing the capability and capacity necessary to meet stockpile requirements.

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question	What was the impact and result of transferring microelectronics manufacturing work from the Kansas City Plant (KCP) to SNL?
Answer	There has been no transfer of microelectronics manufacturing work from KCP to SNL. SNL is currently procuring microelectronics from the private sector that were once procured by KCP. There have been no impacts to delivery schedules due to this change

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question What would be the impact on DOE's high explosives manufacturing capacity and capability if these functions were transferred from the Pantex Plant to LANL and Lawrence Livermore Laboratory (LLNL)? Would this move be cost-effective?

Answer There would be no impact to the DOE's ability to manufacture high explosive components if that mission was transferred to the national laboratories. Both laboratories have significant capabilities through their high explosives RD&T missions Joint assignment of the high explosive production mission to the two laboratories is more expensive than assignment to any of the three sites alone However, the two-laboratory alternative best preserves core competency in high explosives, a critical stockpile stewardship capability The Department has deferred identification of a preferred alternative for the high explosive production mission until all relevant environment, cost, technical, and programmatic evaluations have been completed late this summer.

The Department's Albuquerque Operations Office has recommended that the preferred alternative for the high explosives component fabrication mission should be to move that mission, over time, from Pantex to Los Alamos and Lawrence Livermore National Laboratories. The Secretary has reached no conclusions regarding this recommendation, and no decisions will be made until all relevant environmental, cost, technical, and programmatic evaluations have been completed late this summer.

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question In the cases were the production lines have been transferred, have the Labs produced those components to the same standards and quantities as the production plants historically had?

Answer All war reserve components must meet design specification and be manufactured in accordance with DOE's Quality Control Standard, QC-1, regardless of the site responsible for production. As stated earlier, SNL has already delivered neutron generators that meet these quality requirements.

QUESTION FROM REPRESENTATIVE THORNBERRY

Remanufacture of Nuclear Weapons

[To Curtis and Reis] I remain very concerned as to whether the Department of Energy (DOE) is adequately preserving and maintaining our nation's competency and capability to remanufacture nuclear weapons. I am concerned that the DOE has comprised the country's component manufacturing capabilities as a result of previous decisions by DOE to consolidate manufacturing functions into the design laboratories. The National Defense Authorization Act of 1994 (103-160) requires the core technical competencies of the U.S. in nuclear weapons must be maintained, particularly in manufacturing and surveillance capabilities (among other things). Have we done this? I believe a number of areas need to be examined, including the following:

Question What was the average cost in 1993 of a man-year of effort at LANL, LLNL, SNL, Kansas City, Y-12 Sites and the Pantex Plant.

Answer The average employment costs in 1993 of a man-year effort for the sites in question are as follows:

Laboratory/Site	Direct	Total
Los Alamos National Laboratory	$ 57K	$136K
Lawrence Livermore National Laboratory	$76K	$112K
Sandia National Laboratory	$70K	$143K
Kansas City Plant	$52K	$ 75K
Y-12 Site	$52K	$ 69K
Pantex Plant	$54K	$ 79K

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question [To Curtis and Reis] On November 21, 1995 every member of the Texas congressional delegation, including our two Senators, sent a letter to Secretary O'Leary objecting to a proposal to move high explosives operations away from the Pantex plant. (A copy of that letter is attached). I received an acknowledgment on November 27. It indicated that the response was being prepared by the Office of Defense Programs. That was nearly 3 and 1/2 months ago and I have yet to receive a response. Can you tell me the status of that matter?

Answer Attached is a copy of the letter sent to all members of the Texas congressional delegation.

The Secretary of Energy
Washington, DC 20585

The Honorable Mac Thornberry
U. S. House of Representatives
Washington, D.C. 20515-6415

Dear Congressman Thornberry:

Thank you for your November 18, 1995, letter on behalf of the Texas Congressional Delegation regarding the issue of moving high explosives operations away from the Pantex Plant.

I appreciate the opportunity to clarify the process that the Department is following to determine the appropriate configuration for the future weapons complex. Recent changes in national security needs, coupled with our current budget climate, have necessitated corresponding changes in the way the Department must meet its responsibilities regarding the Nation's nuclear weapons. With projected future workloads for the complex smaller than previously anticipated, and budgetary constraints greater than in the past, the Department is reconsidering the appropriate size and configuration of the weapons complex through preparation of a Stockpile Stewardship and Management Programmatic Environmental Impact Statement.

The Programmatic Environmental Impact Statement is considering alternative configurations of the future complex to determine how best to assure the safety and reliability of the nuclear weapons stockpile in the absence of (1) underground testing and (2) design and production of new weapons types. Alternative sites being considered for the various weapons complex missions are those that have an existing capability/infrastructure to support that mission. For high explosives fabrication, the Department is analyzing alternatives that would either maintain the mission at Pantex or transfer the mission to Los Alamos National Laboratory and/or Lawrence Livermore National Laboratory.

In addition to the environmental analysis being prepared for the Programmatic Environmental Impact Statement, working teams formed by the Department have been analyzing the cost, programmatic, and technical issues associated with the various alternatives. Representatives from all potentially affected sites, including Pantex, have participated in these analyses.

The Department's Albuquerque Operations Office has recommended that the preferred alternative for the high explosives component fabrication mission should be to move that mission, over time, from Pantex to Los Alamos and Lawrence Livermore National Laboratories. I have reached no conclusions regarding this recommendation, and no decisions will be made until all relevant environmental, cost, technical, and programmatic evaluations have been completed. The Department released its Draft Programmatic Environmental Impact Statement in February 1996. There will be a series of public hearings to discuss comments and concerns regarding that document. A Record of Decision is expected in the late summer of 1996. Of paramount importance in any decision will be the need to maintain the continued safety and reliability of the stockpile. The Department will conduct a thorough and fair evaluation of all issues associated with any potential changes to the weapons complex.

Thank you for your attention to this national security issue. If you require further information, please contact me or have a member of your staff contact Dr. Victor H. Reis, Assistant Secretary for Defense Programs, at (202) 586-2181.

Sincerely,

Hazel R O'Leary

Hazel R. O'Leary

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question	[To Curtis and Reis] The Draft SSM PEIS states "comparable facilities also exist at both LLNL and LANL, and either laboratory has sufficient capacity to meet estimated future manufacturing requirements." Does Pantex not have the most modern HE manufacturing facilities in the complex?
Answer	The high explosive facilities at Pantex were built during the 1980's, and are newer than the Los Alamos or Livermore facilities. The equipment in all three facilities was procured at about the same time (sometimes on the same purchase order).

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question [To Curtis and Reis] Is Pantex not the most economical site to perform the high explosive mission? For example, I understand the incremental costs of performing the HE work at Pantex would be $3 million dollars and involve 51 employees. At LANL the incremental cost would be $6 million and involve 65 new direct employees. LLNL would involve an incremental cost of $8 million and would require 100 new direct jobs and 150 new indirect jobs. How does moving HE work to both LANL and LLNL square with "downsizing" and "reducing costs?"

Answer As discussed in the attached draft Stockpile Management Preferred Alternatives Report, the cost to perform the high explosive mission is about the same for any of the three sites Assigning the mission to both Los Alamos and Livermore would be the highest cost alternative, however. In addition to costs, which for high explosives are relatively low for all alternatives, the DOE must also assure continued high explosive competence to support both its stockpile management and stockpile stewardship missions. The amount of future high explosive fabrication work for both stewardship and management is very low compared to historical levels. It is so low that DOE is concerned about continued competency maintenance. For these reasons, DOE is continuing to address the high explosive fabrication mission, and has not as yet selected a preferred alternative

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question	[To Curtis and Reis] Can LLNL and LANL perform at the same high level of expertise and with the same level of facilities the role traditionally played at Pantex in high explosive procurement, evaluation, acceptance, fabrication, and assembly at many sizes and types and different levels of specifications?
Answer	The equipment and capabilities for high explosive fabrication at Pantex, Los Alamos, and Livermore are essentially identical. Pantex has greater experience in fabricating high explosive components to meet production quality standards, however both laboratories have routinely fabricated high explosive parts in the past for the underground nuclear test program and the above ground hydrodynamic test activities. Capabilities of all three sites are sufficient to meet future requirements.

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question [To Curtis and Reis] Since you propose keeping the assembly/disassembly operations at Pantex, why would you propose moving HE fabrication elsewhere, thus creating the new problems of transporting hazardous materials (armed explosive assemblies) repeatedly cross country? Would it not make more sense to manufacture the high explosive assemblies at Pantex and transport them only within the confines of the plant?

Answer Armed high explosive assemblies would not be transported. Machined high explosive parts, without detonators, would be shipped from Los Alamos or Livermore for assembly with detonators into weapons at Pantex under the laboratory alternatives. Transportation of these high explosives would meet all Department of Transportation safety requirements, much as the shipment of high explosives to and from Pantex today is done.

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question [To Curtis and Reis] Explain, in as much detail as possible, how high explosive technical competence can be maintained at the weapons laboratories only if a production mission is assigned? How have LANL and LLNL maintained their technical competencies to date without a production mission?

Answer This subject is discussed in greater detail in the attached draft Stockpile Management Preferred Alternatives Report. However, the issue of maintenance of technical competence, for both development and production, is an issue that the Department of Energy is seeking to assure for all portions of the weapons complex. High explosives are somewhat a special case, and therefore receiving considerable attention at present, because of the large under-utilized facilities and capabilities that exist at Los Alamos, Livermore, and Pantex, the low levels of future development and production requirements, and the essential nature of high explosive technology to the continued maintenance of the nuclear weapons stockpile.

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question	[To Curtis and Reis] If HE manufacturing activities are moved to LANL and LLNL, what are your best estimates of the cost involved in recreating the state-of-the-art facilities at Pantex? What would be the transition cost over the next 5 years associated with moving and establishing the HE production capabilities at each of the labs? What would be the 10-30 year capital cost of such a decision? How do these costs compare to the costs of right-sizing the Pantex facility?
Answer	The costs and schedules for each alternative considered for the high explosive (HE) fabrication mission are provided in the attached draft Stockpile Management Preferred Alternatives Report. Capital and transition costs would be approximately $25 million for Los Alamos National Laboratory (LANL), $28 million for Lawrence Livermore National Laboratory (LLNL), and $32 million for the alternative that would establish HE production shared between LANL and LLNL. Operating costs over 30 years would be $60 million for LANL, $30 million for LLNL, and $84 million for the LANL and LLNL alternative The costs of downsizing the HE mission at Pantex would be $11 million in capital costs, and $60 million for the 30 years of operation.

QUESTION FROM REPRESENTATIVE THORNBERRY

High Explosives

Question [To Curtis and Reis] Could not both LANL and LLNL maintain their respective capabilities on site and in conjunction with centralized HE production operations at Pantex and its state-of-the-art facilities, equipment and processes

Answer This is part of the question the Department of Energy (DOE) is continuing to address. DOE believes that it is essential to maintain high explosive competence at both Los Alamos and Lawrence Livermore National Laboratories to assure stewardship of the stockpile's safety and reliability. At the same time, DOE must maintain a relatively small production capacity to meet ongoing weapon refurbishment activities. Today all three facilities and capabilities are very large and under-utilized

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Fiscal Year 1997 Budget Request Highlights

Question Dr. Curtis, in your personal opinion, do you believe the $3.7 billion budget for Weapons Activities in FY 1997 is adequate? Why or Why not? If additional funds were to be provided, how would you allocate those additional funds? Dr. Reis, do you agree? Dr Tater? Dr. Robinson? Dr. Hecker? Dr. Smith?

Answer We believe that the $3.7 billion budget request for Weapons Activities is adequate to meet the goals for these programs that have been outlined by the President As you know, the President has recently signed the Nuclear Weapon Stockpile Memorandum which sets firm requirements for the stockpile stewardship and management workload for the near term, including a new tritium source. In addition, this budget supports key initiatives in the transition to science-based Stockpile Stewardship for the future without underground nuclear testing as envisioned in the zero-yield Comprehensive Test Ban Treaty Finally, the budget supports sufficient safeguards to permit our nation to resume underground testing if directed, support emergency response capabilities, and reconstitute weapons production capabilities, if necessary.

Our national security depends not only on the nuclear deterrent supported by the Stockpile Stewardship and Management programs in Defense Programs, but also on the health of the nation's economy as indicated in the President's commitment to balance the government's budget. For that reason, we would not be supportive of allocating additional FY 1997 funding beyond what has been proposed in the budget request for Weapons Activities, which represents an increase of 7% over fiscal year 1996.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Fiscal Year 1997 Budget Request Highlights

Question	Dr. Reis, you have testified previously that $4 billion per year is needed to ensure a successful Stockpile Stewardship and Management program. Do you still believe that is an appropriate figure? What capabilities or programs are not being funded that would have been funded had the budget request been at $4 billion?
Answer	I believe that about $40 billion over 10 years will be needed to allow Defense Programs to complete the transition from the Cold War era, when we depended upon new weapon design, underground nuclear testing, and continuing production of new nuclear weapons to maintain our nuclear deterrent, to the new era marked by life extensions of the enduring nuclear weapons stockpile supported by a viable, science-based stewardship program. We believe the funding levels we have requested in FY 1997 are appropriate, balanced, and sufficient to execute planned programs and initiatives needed to support our transition efforts.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Plans for Expending Fiscal Year 1996 Stockpile Management Funds

Question Dr Reis, as we understand it, DOE's plan would use most of the amount allocated for the Savannah River Site for activities associated with the accelerator-production-of-tritium project. Why did DOE choose this approach? Will this mean Savannah River serves only as a "pass through" for funds that ultimately will end up at Los Alamos? Why didn't the Department choose to use the funds to modernize the facilities at Savannah River?

Answer None of the funds will "pass through" to Los Alamos. $17 million of the $21 million allocated for the Savannah River Site will be used for Activities associated with the Accelerator Production of Tritium (APT) project. $3.1 million will be used to support the Commercial Light Water Reactor (CLWR) tritium production project, $1 million will be used to support enhanced surveillance activities

FY 1996 activities at the Savannah River Site (SRS) in support of the APT project include: assistance on the conceptual design report and engineering development and demonstration activities, materials evaluation, safety analysis, NEPA activities, and SRS utility infrastructure evaluation and improvement. FY 1996 CLWR activities include: development of target extraction, transportation, and fabrication capabilities; and support of target design, development, and testing activities necessary to gain Nuclear Regulatory Commission approval for their use in CLWRs. These FY 1996 activities at SRS begin efforts to ensure an orderly transition in responsibilities from the laboratories and, if the APT is built, from the APT prime contractor to SRS in preparation for production.

The FY 1996 Energy and Water Development conference report appropriation language states that it is premature for DOE to initiate long-term capital improvements at our production sites in advance of the outcome of the Stockpile Stewardship/Management Programmatic Environmental Impact Statement process currently underway The Department has chosen to allocate the congressionally added $106 million to the highest priority unfunded activities within the Stockpile Management program. At the same time, we are planning to initiate several conceptual designs within the complex that will support a possible line item construction project in FY 1998 that will, among other things, provide for a modernized complex structured within a significantly smaller footprint.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War) The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship

Question	Dr. Reis, it has been reported that you initially recommended consolidating all nuclear weapons production activities at the weapons laboratories and the Nevada Test Site Do you now agree that the "modernize and downsize in place" strategy is the more appropriate strategy? Why or why not?
Answer	DOE addressed the bounding case of maximum facility consolidation early in its planning efforts to better understand what was technically feasible for the future stockpile management program. This approach was never recommended, however DOE looked at all feasible options, including downsizing the existing plants, before selecting a preferred alternative, which I agree with. That analysis, as described in our draft Stockpile Management Preferred Alternatives Report, shows that while consideration at the laboratories and the Nevada Test Site is technically feasible, it is neither the lowest cost, nor the lowest risk alternative for the range of future stockpile sizes considered.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Question Dr. Reis, what are the anticipated costs, on an FY-by-FY basis, to implement the Department's preferred alternative for Stockpile Stewardship and Management? Are sufficient funds included in the FY1997 and outyear budgets of the Department to implement the preferred alternative? If not, why not, and what is the funding shortfall?

Answer The attached draft Stockpile Management Preferred Alternatives Report shows the annual costs of downsizing and consolidation for each weapons complex site. The total cost to implement the preferred alternative is estimated to be approximately 512 M. Construction for Stockpile Stewardship (National Ignition Firing Facility) would be approximately 1.2B. Implementation would take place between 1998 and 2003. Initial funding to implement the preferred alternative is planned to be requested in the Department's FY1998 budget. Conceptual design and advanced planning efforts will be funded in FY1996 and FY1997 from planned budgets for those years

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

Q. Mr. Curtis, do you agree with the President that a zero-yield CTBT is not verifiable?

A. The Administration believes that the Comprehensive Test Ban Treaty can be effectively verified down to very low levels of nuclear testing. President Clinton outlined a national verification goal of a few kilotons evasively tested in regions of key interest to the United States. This is the equivalent of a few tens of tons nonevasively tested. Remote verification of extremely low yield tests (less than tens of tons) might be possible to accomplish, but only at exorbitant cost and prohibitive intrusiveness.

A zero-yield treaty sets a global standard that nuclear testing will not be sanctioned by the international community at any level. In that sense, a zero-yield test ban is to the advantage of the United States since information gained by the United States about a nuclear test through any intelligence sources can be pursued through the treaty's challenge inspection provisions regardless of the nuclear energy release level. Furthermore, it is unlikely that a primitive proliferant nation would be able to conduct a test and keep the yield down to levels less than a few tens of tons. Even if the proliferator kept the yield low enough to evade detection, he may not possess technology sophisticated enough to gain any valuable design information from the test.

When President Clinton announced his decision to pursue a true zero-yield CTBT, he also stated that a CTBT would be conditioned on, among other things, the continuation of a comprehensive research and development program to improve our treaty monitoring capabilities and operations. These improved technologies, which meet and in some cases exceed U.S. verification goals, are currently being developed and fielded and they will be ready for use by the United States and/or the international community within the next 2 to 3 years.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Question Dr. Reis, how will the Department's plan affect employment at the four production sites and the labs?

Answer Employment at the four plants will be reduced over the next seven years consistent with the reduced production workload and the reduced facility size. Exact employment levels can not be predicted with certainty because of the uncertainty in future work, however a range of expected employment impacts at each plant are contained in the draft Stockpile Stewardship and Management Programmatic Environmental Impact Statement.

A summary of workforce numbers presented (1) at KCP, site employment would be reduced from the current level of 3,300 to 2300; (2) at Pantex, site employment would be reduced from the current level of 3,500 to 1500; (3) at the ORR Y-12 plant, employment would be reduced from the current level of 5,100 to 4,300. At ORR Y-12, approximately 1320 new jobs associated with decontamination and decommissioning (D&D) would be created by downsizing. Savannah River Site would continue its Defense Programs mission, and is not affected by the preferred alternative. There are currently approximately 1000 workers associated with the tritium mission. The employment levels at the laboratories are not expected to change significantly due to the actions proposed in the stockpile stewardship program.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Question DOE's plan calls for developing a capacity to produce plutonium pits at Los Alamos (this capacity used to reside at the now-closed Rocky Flats Plant in Colorado). Dr. Reis, under the Department's plan, will the United States be capable of producing between 50-100 plutonium "pits" by 2003? Does the DOE budget request for FY1997 and the out years include sufficient funds to accomplish this task by 2003? If not, why not?

Answer The Department's preferred alternative for plutonium pit production at the Los Alamos National Laboratory will result in a capacity at Los Alamos of about 50 new plutonium pits per year under normal staffing conditions, and up to about 80 new pits per year when operating multiple shifts. However, we expect pit requirements to be satisfied primarily through re-qualification and reuse of existing pits from retired weapons.

Pending Congressional approval, conceptual design and other pre-Title I activities are scheduled to be carried out within funding contained in the FY 1996 appropriation and the FY 1997 budget request. The construction project for this effort could begin in FY 1998. This schedule would support a completion date of FY 2003. The current Defense Programs outyear budget profiles for FY 1998 thru FY 2000 of approximately $4-4.2 billion includes sufficient funding to accomplish this task.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Question	Drs. Reis and Hecker, why was Los Alamos chosen as the site for plutonium pit construction? How much will it cost to develop such a capability at Los Alamos? Why was Savannah River not chosen for this mission?
Answer	The attached draft Stockpile Management Preferred Alternatives Report shows the cost comparison for the Los Alamos National Laboratory (LANL) versus the Savannah River Site (SRS) alternatives for pit production. In general, it was found that the SRS alternative was more expensive, would take longer to implement, and would involve greater technical risk. Pit production could not be established until two years after the LANL alternative. LANL would have capital costs of 312 M vs. 488 M at SRS. Annual operating costs would be 30 M at LANL vs 60 M at SRS.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

DOE's Plans for Downsizing and Modernizing the Nuclear Weapons Production Complex

DOE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plant, Pantex Plant, Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Question Dr. Reis, when will the U.S. be capable of replicating and re-building any warhead in the nuclear stockpile? Where will this function take place?

Answer DOE builds components for the maintenance and refurbishment of all U.S nuclear weapons at its four production sites and at the Los Alamos and the Sandia National Laboratories. These components are assembled into nuclear weapons at the Pantex Plant. Most components (the notable exception being plutonium pits) can be produced today, and the capability will be maintained during plant downsizing. As stated in the Draft PEIS for Stockpile Stewardship and Management (SS&M PEIS), the preferred alternative for pit production is to upgrade the TA-55 facility at Los Alamos. The Record of Decision (ROD) for the SS&M PEIS is scheduled for August 1996. Regardless of the outcome of the ROD, a limited plutonium pit production capability will be demonstrated at Los Alamos in FY1998. If LANL is chosen for pit production as a result of the ROD, a larger capacity (50-80 new pits per year) will be in place by FY2003. A few components, such as neutron generators, are in the process of being reestablished at new sites, after the closure of production operations at Mound, Pinellas, and Rocky Flats at the end of FY 1994. All of these relocated capabilities are coming on-line on schedules that continue to support stockpile needs. Where these responsibilities have been relocated to a laboratory, the laboratory is demonstrating a level of quality identical to that which existed at the production facilities.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Nuclear Weapons Stockpile Memorandum (NWSM)

Question Dr. Reis, does the Memorandum require a tritium supply sufficient to maintain a START-I level stockpile through 2005 without tapping into the tritium reserve?

Answer No, the Memorandum does not require a tritium supply sufficient to maintain a START I level stockpile through 2005 without tapping into the tritium reserve. The DOE is required to assure tritium is available to support the nuclear weapon stockpile. Under the START I scenario, new tritium would be required in 2005. If a new production source is not available at that time, the tritium reserve would be used to meet requirements until the new production source is available

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues

Question Dr. Reis, what is the estimated cost, on an FY-by-FY basis and over the next decade, to implement the Stockpile Stewardship program? Has the Department allocated sufficient resources to accomplish this mission? If not, why not?

Answer Our estimates for funding the Stockpile Stewardship program in the out years are detailed in the National Security Five Year Plan. Based on these program driven estimates, funding for Stockpile Stewardship will increase from the FY 1997 level of $1.58 billion in FY 1997 to $1.71 billion in FY 1998. Funding estimates for Stockpile Stewardship remain at this level until the last year of the five year period, FY 2002, when the estimates decrease to $1.56 billion. During this same period, the Five Year plan assumes a Weapons Activities program level of between $4 and $4.2 billion a year starting in FY 1998. This level of program will be partially financed by locating offsetting savings found within the Department of Energy, through possible additional user fees, and potential adjustments to discretionary programs in other agencies.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues

Question Drs. Reis and Tarter, what is the link between the National Ignition Facility and the US ability to maintain the US nuclear weapons stockpile? How important is the NIF to being able to recruit and retain competent, skilled scientists and engineers?

Answer The National Ignition Facility (NIF) is the only facility that can approach the high energy density conditions of matter that occur in nuclear weapon detonation. Only the NIF can measure conditions for initiating fusion burn, which is the process that gives the boost in primaries and determines the overall yield in secondaries Specific experiments on the NIF are designed to test stockpile issues and computer-based weapon predictions. Recently, in reviewing these issues, the JASON's, a group of independent scientists familiar with nuclear weapons stated: "...we are convinced that the present inertial confinement fusion program does make important contributions to science-based Stockpile Stewardship and that the NIF will substantially increase this contribution." [p.3 of "Inertial Confinement Fusion (ICF) Review", JSR-96-30, JASON]

The NIF is critical to attracting and challenging the highly skilled scientists and engineers who must make the judgements on reliability of the stockpile. The prospect of using the NIF stimulates current inertial confinement fusion activities and is already attracting needed expertise The recent JASON's review stated [p.4]: "...the ICF program will also play a major role in science-based Stockpile Stewardship by continuing to attract the top quality scientists who will be needed to ensure that the long term goals of science based stockpile stewardship are achieved."

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues

Question Drs. Reis, Hecker, Tarter, and Robinson, are you concerned that funds for new construction projects for Stockpile Stewardship will "rob" funding for so-called "core stockpile stewardship activities? For stockpile surveillance and other management activities?

Answer In FY 1996, Stockpile Stewardship began design activities associated with a number of important programmatic construction projects: the Contained Firing Facility addition at Lawrence Livermore's Site 300; the Atlas Facility at Los Alamos; the Processing and Environmental Technology Laboratory, at Sandia; and, of course, the National Ignition Facility, for which the preferred alternative is to build the facility, at Lawrence Livermore National Laboratory. Support for the laboratories' physical infrastructures continues with the Stockpile Stewardship Facility Revitalization program and the ongoing upgrades to the facility at Los Alamos National Laboratory. With the injunction on construction lifted (4/16/96), we will also proceed with the construction of the Dual-Axis Radiographic Hydrotest Facility at Los Alamos, based on the Department's completion of the EIS process and issuance of a Record of Decision.

These are all important projects that are required for the implementation of the Stockpile Stewardship program. They are the tools around which stewardship will exist. In a very real sense these projects are "core stockpile stewardship" activities. As such, we have always assumed funding for the projects in our program planning to insure that adequate funds are available for their construction and use, and to insure that the funding did not come at the expense of other necessary activities. So, while it is true that we continue to put pressure on the laboratories to insure that the core program stays focused on the highest priority research activities, we have not forced them into a situation of trading necessary scientific research for necessary scientific research capabilities.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues

Question Drs. Reis and Hecker, what are the purposes of the Los Alamos Neutron Scattering facility (LANSCE) and the Dual-Axis Radiographic Hydrotest facility (DARHT) based at Los Alamos? How much will this facility cost, and how important is it for the nuclear mission? What is the current legal status of the DARHT construction project? When will its legal status be resolved?

Answer LANSCE (Los Alamos Neutron Science Center is the new definition of the acronym LANSCE) now has in place a substantial program focused on its key mission of stockpile stewardship. To concentrate on the nuclear mission, the program has been divided into five projects: Advanced Radiography as a supplement/alternate to traditional hydrotest x-radiography and for nondestructive probing of weapons for defects; Weapons Material Science for metal and polymer aging studies using established neutron scattering techniques as well as advanced material science studies of weapon materials such as plutonium; Weapons Nuclear Physics for high-precision measurements of nuclear parameters for weapon performance codes; High-Explosive Characterization for measurements using pulsed low-energy neutron beams; and Weapons Performance Physics for linkage of LANSCE experiments to physical models and computer codes used in understanding the performance, safety and reliability of the enduring stockpile.

LANSCE is an operating facility costing $35 million per year to operate. The facility will support the National Ignition Facility program by evaluating damage effects in optical material, and the accelerator production of tritium program through high-precision measurements of relevant nuclear parameters. LANSCE will serve as a magnet for attracting bright new scientists and engineers to the weapons laboratories, a critical need for providing long-term stockpile stewardship in the post-testing era.

DARHT is planned to replace an aging, 35-year old hydrotest facility (PHERMEX), resulting in a facility incorporating modern technology designed to better support stockpile stewardship in the absence of underground nuclear testing. Assuming our release to complete the facility, DARHT will help in surveillance of the stockpile through a regular series of hydrotests designed to provide benchmark performance of stockpile systems. It will also provide a test bed for the advanced technologies to be incorporated in the next generation radiographic facility.

The estimated cost to construct the DARHT facility envisioned in the Environmental Impact Statement (EIS completed August 1995), Record of Decision (ROD issued October 1995) is about $187 million, of which $106 million is for the first axis and $81 million is for the second axis, as detailed in the budget narrative construction project data sheet. Hydrotesting has been recognized as the most important experimental capability in the weapons program, short of nuclear testing, for assuring the safety, reliability , and performance of the stockpile. The DARHT facility is a new generation x-ray radiographic facility with superior penetration and resolution capability to perform nonnuclear hydrodynamic testing of weapons systems primaries. By virtue of its dual axes, DARHT will allow simultaneous viewing from two different directions, which will be important for safety studies as well as assessment, validation and further development of predictive capability. Furthermore, while staying within the bounds of the EIS and ROD, one axis may provide up to a four-pulse capability during a single hydrotest, allowing time-dependent effects for performance and safety to be studied in detail. A major component of testing to be carried out at DARHT will involve the assessment of aging effects in the nuclear weapons stockpile.

Construction of the DARHT was enjoined by a Federal Court Order in January 1995 pending completion and judicial review of the EIS and associated ROD Based on the ROD, the Department of Justice (DOJ) requested the Federal District Judge to dissolve the injunction which halted DARHT construction. The ROD states the Department's intention to finish the facility using new and improved technology as appropriate, and also directs implementation of a phased containment process to reduce by 75% the environmental emissions from radiographic hydrotesting. The court lifted the injunction on April 16, 1996.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues: Technology Transfer

Question Dr. Reis, Hecker, Robinson, and Tarter, Congress last year cut funds for Technology Transfer activities, based on concern that these programs provide little, if any, benefit to the nuclear weapons mission What changes in the program have been adopted to ensure that it is focused on the primary mission of the laboratories--namely, supporting the nuclear weapons stockpile? If not, why not?

Answer The Defense Programs Technology Transfer Program traditionally emphasized a combination of projects and programs that strongly supported the core competencies at the laboratories and facilities and provided some benefit to the nuclear weapons mission. Over the past year, the program has been strengthened by involving the weapons program mangers and staff in project and program selection and activity. The program has also been transitioning to projects which are weapons specific, and we have been stressing projects which support the Accelerated Strategic Computing Initiative, advanced information infrastructure for the weapons complex, and advanced manufacturing Projects which do not support such goals have been reduced, canceled or transferred to other programs wherever possible. We have further reduced the budget request for FY 1997 and expect to transfer several sets of projects to other DOE offices, to more closely align them with Department priorities and to focus the technology transfer program entirely on the weapons programs.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

Advanced Supercomputing Initiative

Question Drs. Reis, Hecker, Tarter, and Robinson, what are the objectives of the Advanced Supercomputing Initiative (ASCI)?

Answer ASCI will create leading-edge computational modeling and simulation capabilities critically needed to promptly shift from nuclear test-based methods to computational-based methods integrating stockpile stewardship elements and providing an integrated nuclear explosion testbed. ASCI has three main thrusts: weapon application development, high performance computing for weapon applications, and a tri-lab distributed problem solving environment.

ASCI will develop the high-performance prediction software and applications codes needed to implement an assessment and evaluation of integrated nuclear weapons systems in areas of performance, reliability, safety, aging, remanufacture and reconstitution. ASCI will seek to provide simulations that embody all the physics necessary to predict weapon behavior while simultaneously eliminating empirical factors, as appropriate. ASCI simulation and code development will focus mainly on integrated weapon system behavior and the fundamental models that describe the underlying scientific phenomena. The codes will integrate and accelerate 3-D capability, finer resolution, subgrid modeling, and more refined physics to obviate the need for verification of results through underground tests. The nuclear performance applications will be verified and validated using data from a range of non-nuclear test facilities, laboratory experiments, and historical underground tests. These weapon applications codes will be designed for high performance on advanced computers using massively parallel processing architectures.

The simulation of nuclear weapons requires a weapon applications capability improvement

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Advanced Supercomputing Initiative

Question	What is its status?
Answer	ASCI is well underway. In FY1996, ASCI funded 11 new code or constituent model start-up efforts. Four of these code starts focus directly on increasing the ability of laboratories to predict the integrated performance and safety of weapons through computational means. On August 22, 1995, the Secretary of Energy announced the Defense Programs procurement of the world's fastest computer to be delivered to Sandia National Laboratories in December 1996. This computer will run at more than one trillion operations per second and will be dedicated to solving difficult weapons problems On February 20, 1996, the Department, through Los Alamos and Lawrence Livermore National Laboratories, announced competition for a follow-on system that will explore a different architecture and will run at three trillion operations per second. In order to support collaboration among ASCI researchers at the three laboratories, the first secure high-speed data network linking the Los Alamos, Sandia and Lawrence Livermore National Laboratories was established on October 20, 1995. During FY 1997 the ASCI program will continue development of the codes started in FY 1996, including the delivery of initial capabilities needed to certify planned near-term stockpile modifications (e.g. W76 re-certification, W88 pit rebuild, and B61 Mod 11). FY 1997 will also see the delivery of the one trillion operations per second computer and two development systems for the three trillion operations per second computer. Significant modeling, software, and infrastructure work will be required to enable weapons code development and simulation on those computers.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Stockpile Stewardship Issues

Question What are the objectives of the Enhanced Surveillance Program? Where this work be performed? Is this program under-funded in FY-97? If so, by how much?

Answer The objective of the Enhanced Surveillance Program is to develop tools, techniques and models that will enable us to provide advanced capability to measure, analyze, calculate and predict the effects of aging on weapons materials and components and to understand these effects on the reliability, safety and performance of existing weapons beyond their original design life.

The main objectives of the program are to: develop improved methods for degradation/failure detection, develop sensors and monitor critical components in place, in real time, non-destructively, analyze materials, components versus time, move surveillance program from reactive to more predictive detection, and develop a joint DOE-DOD schedule for stockpile maintenance/refurbishment.

The activities under this program will be carried out at the DOE weapon production plants and design laboratories - the Kansas City Plant, Y-12 Plant, Savannah River Site, Pantex Plant, Los Alamos National Laboratory, Lawrence Livermore National Laboratory and Sandia National Laboratories. There is a strong coordination and teaming between the labs and production sites for the planning, selection, and conduct of research projects for this program.

The current FY97 funding is $40 million. The program is not under-funded in FY 1997.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Nevada Test Site

Question Dr. Reis, in the absence of underground nuclear testing, what is the mission of the Nevada Test Site? What is the annual budget for the Test Site, and how has that amount changed over the last decade?

Answer The primary mission of the Nevada Test Site (NTS) is to support the Department's Stockpile Stewardship program through maintaining the readiness to return to testing if directed by the President. The most significant element of this program is the subcritical experimentation. Subcritical experiments involve high explosives and special nuclear material and will provide valuable data that cannot be obtained using other techniques or at other locations. In addition, these experiments will help maintain nuclear test readiness by employing many operations similar to nuclear testing including assembly of high explosives and special nuclear material, diagnostic instrumentation calibration, and emplacement. The Weapons Activities FY 1997 request for NTS is $202 million, a decrease of $394 million since FY 1987.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Nevada Test Site

Question Dr. Reis, when will the Congress receive the report on nuclear test readiness postures, required by Section 3152 of the National Defense Authorization Act for FY96 (Public Law 104-106)? Where does the Department come down in the balance between efforts to minimize costs at the Test Site, on the one hand, and retaining the capability to test within a short period of time, on the other? Why?

Answer It is our plan to submit to Congress the report on nuclear test readiness postures, required by Section 3152 of the National Defense Authorization Act for FY96 (Public Law 104-106) by July 30, 1996.

DOE has identified a cost-effective approach to maintaining nuclear test readiness as a by-product of the experimental program. This is primarily through the conduct of DOE Defense Programs experimentation activities at the Nevada Test Site (NTS) as part of the Department's Stockpile Stewardship program. The most significant element of this Program is the subcritical experimentation program. Subcritical experiments involve high explosives and special nuclear material and will provide valuable data that cannot currently be obtained using other techniques or at other locations. These experiments will also help maintain nuclear test readiness by employing many operations similar to nuclear testing, including handling and assembly of high explosives and special nuclear material, diagnostic instrumentation calibration, and emplacement.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Nuclear Materials Protection, Control, and Accounting

Q. Ms. Rohlfing, please explain why an increase of $24 million is needed in FY 97 (as compared to FY 96 funding) for nuclear MPC&A in the former Soviet Union. Is this program intended to enhance safety at all Ministry of Atomic Energy (Minatom) and Ministry of Defense sites?

A. Over the past year, the Department of Energy has vigorously pursued new and expanded areas of cooperation to improve the protection, control, and accounting of nuclear materials with the states of the former Soviet Union. This program is intended to enhance MPC&A at all of the sites which contain highly enriched uranium and separated plutonium in other than fully assembled weapons. For example, in FY 95, the scope of our activities expanded to an additional 19 locations where MPC&A improvements were begun and to date in FY 96, 18 additional locations have been incorporated into the program. As our project teams at each site begin to define our joint activities, the scope of work frequently expands to include additional facilities within each site where weapons useable nuclear materials are stored or processed. While work at some locations is mature and well defined, the addition of this large number of locations has dramatically increased the scope of work that will be accomplished. Additional funding will permit us to take advantage of the opportunities to rapidly improve nuclear material protection, control, and accounting at these facilities. Plans are in place to allocate these additional funds to first make improvements at those facilities where the risk can most rapidly be reduced.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Q. Ms. Rohlfing, what is the relationship between the DOE's efforts to improve nuclear security in the former Soviet Union, and DOD's efforts in this area under the Cooperative Threat Reduction (CTR) program? How would you characterize coordination between the two Departments and why?

A. DOE's efforts to improve nuclear security in the former Soviet Union and DOD's CTR program are distinct yet complementary programs. DOE works closely with the Ministry of Atomic Energy (Minatom), the Russian nuclear regulatory agency (Gosatomnadzor), and with independent institutes with nuclear materials.. DOD's contacts are primarily with the Russian Ministry of Defense. While both the DOE and DOD programs work to improve nuclear security, the DOE programs specifically focus on nuclear materials, whereas DOD's programs address intact weapons. There are areas where coordination is needed, such as Material Control and Accounting provisions for the nuclear storage facility being built jointly by DOD and Minatom for materials removed from dismantlyed weapons. This coordination is taking place, and is growing as the scope of work expands.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

Q. Mr. Curtis, do you agree with the President that a zero-yield CTBT is not verifiable?

A. The Administration believes that the Comprehensive Test Ban Treaty can be effectively verified down to very low levels of nuclear testing. President Clinton outlined a national verification goal of a few kilotons evasively tested in regions of key interest to the United States. The seismic signal of such a test is equivalent to a few tens of tons nonevasively tested. Remote verification of extremely low yield tests (less than tens of tons) might be possible to accomplish, but only at exorbitant cost and prohibitive intrusiveness.

A zero-yield treaty sets a global standard that nuclear testing will not be sanctioned by the international community at any level. In that sense, a zero-yield test ban is to the advantage of the United States since any information gained by the United States about a nuclear test can be pursued through the treaty's challenge inspection provisions regardless of the nuclear energy release level. Furthermore, it is unlikely that a primitive proliferant nation would be able to conduct a test and keep the yield down to levels less than a few tens of tons. Even if the proliferator kept the yield low enough to evade detection, he may not possess technology sophisticated enough to gain any valuable design information from the test.

When President Clinton announced his decision to pursue a true zero-yield CTBT, he also stated that a CTBT would be conditioned on, among other things, the continuation of a comprehensive research and development program to improve our treaty monitoring capabilities and operations. These improved technologies, which meet and in some cases exceed U.S. verification goals, are currently being developed and fielded and they will be ready for use by the United States and/or the international community within the next two to three years.

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

Q. How much will it cost to effectively monitor a CTBT? Is funding for this activity included in the President's budget request? Is this effort fully funded over the next five years?

A. The "Annual Report for Enhancing U.S. Comprehensive Test Ban Treaty Monitoring Capabilities," written by the CIA/Arms Control Intelligence Staff and coordinated with other agencies, gives specifics for U.S. national monitoring costs to verify effectively the CTBT. This information is classified and will be provided separately to the Committee. Funding for CTBT monitoring is included in the President's budget request, and support for nuclear test treaty verification and monitoring remains a high priority within the Department of Energy.

Aside from U.S. national monitoring capabilities, the exact structure of the CTBT International Monitoring System (IMS) is still being negotiated at the Conference on Disarmament in Geneva. In addition, on-site inspection treaty provisions and possible associated transparency measures also remain under active discussion. Funding for the IMS, of which the United States will likely fund about 25%, is therefore, not reflected in the "Annual Report for Enhancing U.S. Comprehensive Test Ban Treaty Monitoring Capabilities," or in the President's budget. These amounts are in addition to baseline costs associated with national monitoring capabilities.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Implementing the North Korean Nuclear Agreement.

Q: Ms. Rohlfing, what can you tell us about North Korea's compliance with the terms of the Agreement? To which country will the nuclear fuel rods be transferred, and when will this occur?

A: The Department of State is the responsible entity for monitoring the Democratic People's Republic of Korea's compliance with the U.S.-DPRK Agreed Framework. It is recommended that this inquiry be directed to Department of State for an authoritative response.

The Agreed Framework provides for the disposition of the fuel in a safe manner that does not involve reprocessing in the DPRK. The Agreed Framework calls for U.S.-DPRK cooperation on methods of safe storage while the Light Water Reactors are supplied. No decision has been made concerning the destination of the DPRK's spent fuel rods or the date of movement from DPRK at this time.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

Q. Ms. Rohlfing, what is the status of negotiations in Geneva on a CTBT?

A. Following the consensus adoption of the CTBT resolution in the 1993 United Nations General Assembly, multilateral negotiations on a Comprehensive Test Ban Treaty began in the Conference on Disarmament (CD) in Geneva in January 1994. Negotiations continued through 1995 and into 1996. There is currently a "rolling text" of the treaty, as well as several national attempts to create "visionary" treaty texts, most notably a "clean" text recently introduced by Australia .

President Clinton's August 11, 1995 announcement that the United States would support a true zero yield CTBT energized negotiations. Following the U.S. announcement, the United Kingdom and France also declared their support for a true zero yield CTBT that will ban any nuclear weapon test explosion or any other nuclear explosion. After his Hyde Park summit meeting with President Yeltsin, President Clinton announced on October 23, 1995, that the United States and Russia had agreed jointly to pursue a zero yield CTBT. Many of the CD's 38 members welcomed these developments.

The Conference on Disarmament is close to finalizing the structure of the International Monitoring System and the number and location of its seismic, radionuclide, hydroacoustic and infrasound sensors. Russia has proposed enhanced monitoring at the nuclear test sites, and the United States is currently attempting to meet Russian concerns to ensure equivalence of monitoring capability at these sites.

Other issues which remain to be resolved in the multilateral negotiation include requirements for treaty entry-into-force and on-site inspection provisions.

It is the goal of the United States to conclude negotiations in Geneva as soon as possible so that the treaty can be sent to the 51st United Nations General Assembly this fall to be open for signature.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT
HOUSE COMMITTEE ON NATIONAL SECURITY

Implementing the North Korean Nuclear Agreement

Q: Ms. Rohlfing, DOE last year told the Committee that it would take $10 million to implement DOE's portion of the U.S.- North Korean nuclear agreement. Then, later in the year, we were told DOE needed an additional $3.6 million. Now DOE is requesting an additional $5 million in FY 97 for this project. Why? Has the scope of work expanded? Why has the cost of this project increased so? Hasn't the work already been completed?

A: The U.S.-DPRK Agreed Framework signed in October 1994 provided for a 'freeze' of the DPRK weapons program in place while plans were formulated for supply of two light water reactors to DPRK. Important aspects of the nuclear weapons freeze included: (1) securing the discharged spent nuclear fuel from DPRK's weapons program; (2) shutdown and eventual dismantlement of the DPRK's graphite reactors; and (3) eventual disposition of spent nuclear fuel from DPRK without reprocessing. The spent nuclear fuel the Department is canning holds approximately 25-30 kilograms of plutonium capable of making 5-6 nuclear weapons; the 'freeze' forestalls replenishment of North Korea's capacity to produce weapons-grade plutonium.

The basic scope of DOE's work to implement the Agreed Framework remains treatment and stabilization of the spent fuel pool water at the Nyongbyon 5 MW(e) research reactor spent fuel storage facility and accomplishment of safe storage of the spent fuel in canisters under IAEA safeguards until final disposition can occur.

As background, in January and February of last year, the Under Secretary of the Department testified to the Congress that a $10 million reprogramming would be required to deal with the fiscal year 1995 spent fuel responsibilities. He also noted that "prompt approval of these funds is crucial if we are to build upon the progress" recently made possible by unprecedented access by our personnel to formerly secret sites. It was duly noted that " if funding to start the water treatment and fuel canning is delayed or if there are unexpected delays in our access, costs could increase because the water in the basin will have become more contaminated and the water treatment system will have to deal with larger quantities of highly radioactive fission products and transuranic actinides dispersed into the water." It was emphasized that "prompt performance on arresting the corrosion of the fuel and placing it into safe storage is essential if the spirit of cooperation which was evident during the recent site visits...is to continue." In addition, it was also noted that there would be ongoing activities, such as verifying the spent fuel cans are not leaking, maintaining the clarity and temperature of the basin for safeguarding and safety purposes -- that based upon "the best available estimates at this time suggest that funding of approximately $1 million per year will be required during the estimated four to seven year period starting in fiscal year 1996 during which the fuel will remain in temporary storage in North Korea."

Specifically, the $10 million reprogramming notification in January 1995 highlighted that there was an element of uncertainty in scoping the requirements for the materials and personnel support for this project. The $10 million was an initial estimate derived in January 1995 with no other known benchmark for this task. It was indicated that no other similar project had been accomplished and there was no simple accounting mechanism to factor in the element of difficulty working with the DPRK on such a project. Indeed, by the time all Committee responses to the January 1995 reprogramming notification were received by June 1995, the conditions of the spent fuel were more challenging and required the introduction of further equipment (generators and two chillers), and required further negotiation with DPRK -- all of which complicated progress and increased the cost estimates from January 1995.

The U.S. Spent Fuel Team has nonetheless made significant progress since stabilizing the fuel pool, including delivery and installation of equipment and has had U.S. personnel continuously working at the Nyongbyon facility since September 1995. All the canisters for the some 8,000 rods have also been constructed. There have been, however, unforeseen diplomatic delays, technical problems and cultural issues which have caused the unanticipated extension of the schedule and therefore, the increase of the project costs.

The $3.6 million for FY96 was anticipated for follow-on, post-canning maintenance and fuel characterization. However, because of the schedule extension, this has been utilized to continue the original spent fuel canning activity. This has required the request for $5 million to complete canning and perform the additional post-canning activities, delayed from FY96, including studies on the disposition of the spent fuel to be scheduled in FY97, which will provide important information for the Western country ultimately taking receipt of the fuel and thus getting the fissile material out of DPRK.

This project is comprised of primarily three phases: first, water treatment to stabilize and treat pool water to limit and reverse the growth of algae and slow the corrosion of the spent fuel elements; second, removal of the thick sludge from the pool floor caused by the corrosion of the MAGNOX fuel elements cladding; and third, cleaning and conditioning of the fuel elements and placement in storage canisters for securing in storage racks under IAEA safeguards. The first phase was completed in September 1995 which has clarified the pool sufficiently to allow moving the spent fuel baskets to an adjacent pool and performing other activities in the pool. Sludge caused by the corrosion of MAGNOX cladding has accumulated on the floor of the pool to a depth of 8 inches. Removal of this sludge by vacuuming was completed at the end of January 1996 which has provided visibility of the floor for placement of storage racks and other canning equipment. Final check out and testing of the four canning stations has been completed. Following agreement between IAEA and DPRK concerning procedures for fuel measurements, it is expected that fuel baskets will begin moving from the adjacent pool to the canning stations to commence the final critical project phase of cleaning, conditioning and canning the 8,000 fuel elements.

The completion of DOE spent fuel activities, pursuant to the Agreed Framework, is critical to U.S. national security as they remove any incentive or pretext for the DPRK to reprocess plutonium and reduce tensions on the Korean peninsula where 37,000 U.S. troops are stationed.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

A Resumption of Russian Nuclear Testing?

Q. Mr. Curtis and Ms. Rohlfing, press reports suggest that in mid-January of this year, Russia conducted an underground nuclear test at its northern test site. Can you confirm that such a test did in fact occur? What do we know about the test?

A. We are aware of certain activity at a Russian nuclear test site, which, though inconclusive, is similar to activity that has been associated with previous nuclear tests. We are not able to confirm that a nuclear test has taken place.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

Up-coming "Nuclear Security Summit" in Moscow

Q. Ms. Rohlfing, how serious is the nuclear smuggling threat? How would you characterize the attempted smuggling incidents we have seen to date? What actions are under consideration within the Executive Branch to counter the smuggling threat?

A. The Department of Energy considers the nuclear smuggling threat to be very serious. Substantial quantities of materials remain inadequately protected around the world, in our views -- particularly in the former Soviet republics, but also potentially in proliferant countries outside international controls -- and demand on the part of aspiring proliferants, terrorist organizations, and subnational groups remains strong.

Known and verified fissile materials smuggling incidents numbered only five in 1994 and dwindled to zero in 1995, however.

- In May 1994, a minute quantity of ultra-pure plutonium-239 was seized in Germany.
- In June 1994, three kilograms of what was reported to be highly-enriched uranium were seized in St. Petersburg. To our knowledge, the Russians have not shared specific information about the enrichment level of this material.
- In August 1994, several hundred grams of plutonium compounds were seized at the Munich airport in a highly-publicized incident.
- In June and December 1994, 87.5-percent enriched uranium was discovered in two separate cases: 0.8 grams in Bavaria and 3 kilograms in Prague.
- One 1995 case in Ukraine bears mention because of the individuals involved,

although it is not a confirmed fissile materials case. In March 1995, two former Russian military officers were arrested in Ukraine with six kilograms of uranium. Although we do not know the enrichment of this material, the fact that former military personnel were involved underlines concerns about the reliability of nuclear complex personnel in the former Soviet Union.

We believe the absence of a flood of reported genuine nuclear materials smuggling incidents following the collapse of the Soviet Union is attributable to a variety of factors. These include that Russian law enforcement has made counter-smuggling a priority -- thus denying criminals access to materials -- and that cooperation between Russia and DOE to improve security at nuclear facilities is helping to reduce the potential supply. But we do not believe the future threat has disappeared; rather, demand is more likely to assume different, more complex forms in adapting to more stringent controls.

US policymakers have numerous programs underway and planned to help counter this threat. The Department of Energy's programs fall into three general categories.

- **Securing materials, expertise, and technologies (preventative measures).** These efforts include cooperative programs with governments of the Former Soviet Union (FSU) to improve materials control, protection and accountability (MPC&A) and the nuclear regulatory infrastructure in the FSU; an Industrial Partnering Program (IPP) to stabilize resources of potential proliferation risk in those countries; and assistance to FSU states in enhancing effective export controls.

- **Detecting and characterizing demand.** The Department conducts analysis and monitoring of the demand for and movement of nuclear materials and technologies, in some cases in cooperation with foreign governments. DOE also develops technologies to detect, monitor and verify the movement and/or origin of smuggled nuclear materials.
- **Response and counterproliferation.** DOE's Nuclear Emergency Response Team (NEST) conducts search, identification, disablement, and containment activities for suspected nuclear devices, with threat assessment input from the Department's emergency management system. We also support the counterproliferation program of the Department of Defense.

QUESTION FROM THE SUBCOMMITTEE ON MILITARY PROCUREMENT HOUSE COMMITTEE ON NATIONAL SECURITY

U.S.-Russian Talks on the Nuclear "Safeguards, Transparency and Irreversibility"(STI) Initiative

Q. Two years ago, the U.S. and Russia agreed to develop steps to ensure the transparency and irreversibility of the process of reducing nuclear weapons. Since then the U.S. has submitted proposals that would result in an exchange of data on the sizes, makeups, and histories of the U.S. and Russian nuclear arsenals and their stockpiles of weapons-usable uranium and plutonium. The U.S. has also proposed mutual inspections of warhead storage and dismantlement sites to verify the rate at which nuclear weapons are being dismantled, the numbers that await dismantlement and the numbers that have been dismantled already. Mr. Curtis and Ms. Rohlfing, what is the status of these talks? Why has Russia resisted moving forward on this project? Is the DOE concerned that U.S. nuclear warhead design information might be revealed during any such inspections? Why or why not?

A. The Safeguards, Transparency and Irreversibility Initiative (STI) was designed to increase the transparency and irreversibility of the process of nuclear dismantlement as called for in the January 1994, September 1994 and May 1995 Summit Statements. The Initiative involves negotiations on a variety of agreements which fall under the STI umbrella. The linchpin of the entire STI initiative is the Agreement for Cooperation in Sharing Classified and Sensitive Information. Negotiations on this Agreement had preceded to the point where only a few brackets remained in the joint draft text when, in November 1995, the Russians abruptly called off all negotiations pending a Russian interagency review of the entire STI program. Reciprocal visits by security experts from each side, as called for in the Atomic Energy Act of 1954, amended, have taken place with satisfactory results. Additionally, negotiations were almost completed on the Plutonium Mutual Reciprocal Inspections Demonstration Agreement. This Agreement is the first step in fulfilling the O'Leary/Mikhailov Joint Statement on Inspection of Facilities Containing

Fissile Material Removed from Nuclear Weapons. Most of the technical annexes of the Demonstration Agreement had been agreed to when the Russians again canceled or delayed any further negotiations. Other STI elements, such as the Stockpile Data Exchange Agreement, have been presented to the Russians in the form of a U.S. draft, but no Russian comments have been received.

The Russian Federation has no experience in the reciprocal sharing of nuclear weapons information with any other government. The Russians have expressed concerns about the ability of the U.S. to protect Russian information that will be exchanged under STI. For this reason the U.S. has moved to complete the Security Annex of the Agreement for Cooperation first in order to help alleviate these worries. The current political situation in the Russian Federation, including the impending June Presidential election, and the possible increase in the number of Communist Party seats in the Duma, has also had its effect on the progress of STI negotiations. Finally, it has been very difficult for the Russian arms control interagency to get itself organized to undertake negotiations on STI.

The Department of Energy assembled a panel of U.S. nuclear weapons experts to assess the effect on U.S. security of classified information that might be revealed to the Russians on a reciprocal basis by the STI initiatives. The experts concluded that information such as the mass, isotopic content, and rough shape of a pit, would not harm the security of the U.S. if revealed to the Russian Federation. This conclusion assumes that the Russians will keep this information secure from third parties, and reemphasizes the need for a completed Security Annex to the Agreement for Cooperation. This is not to say that the information selected for exchange with the Russians on a classified basis should be declassified or widely disseminated, but given our knowledge of the sophistication of the Russian nuclear weapons program revealing this information to the Russians would cause no harm to this country. As the STI initiative proceeds into other areas, DOE will continue to assess what information might be revealed and its impact on U.S. national security.

QUESTION FROM THE HOUSE NATIONAL SECURITY COMMITTEE SUBCOMMITTEE ON MILITARY PROCUREMENT

DOE's Fissile Materials Long-Term Storage and Disposition Plan

Q. Dr. Curtis, what is the estimated total cost to store and dispose of excess U.S. plutonium and highly-enriched uranium?

A. While final cost estimates are not yet complete and the set of storage configurations and disposition technologies finally selected for surplus plutonium disposition have not yet been determined, a preliminary estimate is that the design and construction costs could range from slightly over $1 billion to just over $2 billion over a 6 to 10 year period. Although a portion of that cost could be offset by receipts from the sale of fuel or electricity in reactor burning options, the life cycle cost of providing new facilities and establishing the necessary infrastructure to accommodate the plutonium fuels could significantly exceed the value of the energy.

Unlike plutonium, surplus U.S. highly enriched uranium can be rendered non-weapons-usable by blending it down to low enriched uranium for use in commercial reactor fuel. This is the most rapid path for neutralizing the proliferation threat and is consistent with the course of action now underway in Russia to reduce highly enriched uranium stockpiles. Over time, down blending of the surplus highly enriched uranium for use as commercial low enriched uranium fuel could yield an estimated net value of several hundred million dollars.

The Department is currently completing environmental, technical, cost and schedule analyses for the range of potential decisions on storage and disposition of both highly enriched uranium and plutonium. The Record of Decision for the disposition of surplus highly enriched uranium is scheduled for the second quarter of 1996. The Record of Decision for the long-term storage of all weapons-usable fissile materials and technologies and systems for the disposition of surplus fissile materials is planned for late 1996. Final cost and schedule estimates will be completed later this year to support the Records of Decision.

QUESTION FROM THE HOUSE NATIONAL SECURITY COMMITTEE SUBCOMMITTEE ON MILITARY PROCUREMENT

DOE's Fissile Materials Long-Term Storage and Disposition Plan

Q. Dr. Curtis, The Department did not identify a "preferred alternative" for the long-term storage and disposition of fissile materials. When will such a decision be forthcoming? Why did the Department choose to delay the announcement of a preferred alternative? What costs are associated with such a delay?

A. A "preferred alternative"was not designated in the draft Programmatic Environmental Impact Statement (PEIS) that was released in late February 1996, since the Department has not fully developed a "preference" regarding the storage and disposition of surplus weapons-usable fissile materials. One or more "preferred alternatives" will, however, be identified in the final PEIS scheduled for release in late 1996. The Department is in the process of identifying one or more "preferred alternatives" in light of environmental analyses, public comment, and policy considerations. At about the time of the final PEIS, the Department will make public the results of technical, cost and, schedule analyses associated with the issuance of the Record of Decision. The identification of a "preferred alternative" in the final PEIS is consistent with the Council on Environmental Quality regulations implementing the National Environmental Policy Act and is in accord with the Department's plans for the preparation of the PEIS. As a result, there has been no delay in the identification of a "preferred alternative" and no additional costs associated with this approach.

QUESTION FROM THE HOUSE NATIONAL SECURITY COMMITTEE, SUBCOMMITTEE ON MILITARY PROCUREMENT

DOE's Fissile Materials Long-Term Storage and Disposition Plan

Q. Dr. Curtis, please describe for us the options currently under consideration and how each would affect the surrounding communities.

A. The Department is considering three alternatives for the storage of weapons-usable fissile materials in the Programmatic Environmental Impact Statement, plus a "no action" alternative required by the National Environmental Policy Act. The three alternatives are: facility upgrades and storage of plutonium at multiple DOE sites (upgraded or new facilities); consolidated storage of plutonium at one DOE site (new facilities); and collocated storage of plutonium with highly enriched uranium at one DOE site (new facilities).

Six Departmental sites are being analyzed for the long-term storage mission. These are: Hanford Reservation, Richland, WA; Idaho National Engineering Laboratory, Idaho Falls, ID; Nevada Test Site, Las Vegas, NV; Oak Ridge Reservation (Y-12 Plant), Oak Ridge, TN; Pantex Plant, Amarillo, TX; and Savannah River Reservation, Aiken, SC

Three basic alternatives for the disposition of surplus weapons plutonium are being considered: burn as MOX fuel in reactors, immobilization in glass or ceramic form and deep geologic disposal. Additional site specific analyses will be performed prior to implementing the selected disposition technology(s).

Additional details on the above, including potential environmental impacts on the surrounding communities, are provided in the attached fact sheets and attachments to the Draft Programmatic Environmental Impact Statement.

Attachments:
- Long-Term Storage Alternatives Fact Sheet
- Plutonium Disposition Alternatives Fact Sheet
- Attachments A and B, Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement - Summary

Page 1 of 3

Office of Fissile Materials Disposition

Long-Term Storage Alternatives

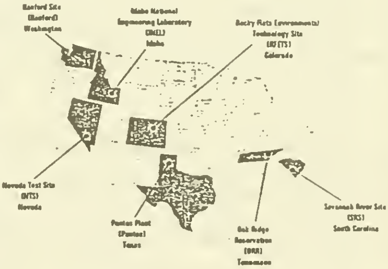
Fact Sheet

United States Department of Energy

WEAPONS-USABLE FISSILE MATERIALS

- Surplus and nonsurplus plutonium (Pu), except Pu-238
- Nonsurplus highly enriched uranium (HEU)
- Surplus HEU that cannot go from interim storage to disposition within 10 years

DOE SITES ANALYZED



For further information contact:
U.S. Department of Energy, Office of Fissile Materials Disposition, MD-4,
Forrestal Building, 1000 Independence Ave., SW, Washington, D.C. 20585

Page 1 of 1

CONSOLIDATION OF PLUTONIUM

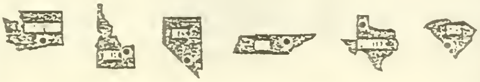
- All Pu materials would be removed from existing sites and consolidated at new or modified Pu storage facilities at one of the candidate sites

– AND –

- Existing HEU storage facility(s) would be modified or maintained

COLLOCATION OF PLUTONIUM AND HIGHLY ENRICHED URANIUM

- All Pu and HEU would be consolidated and collocated at new, modified, or existing storage facilities at one of the candidate sites



For further information contact:
U.S. Department of Energy, Office of Fissile Materials Disposition, MD-4,
Forrestal Building, 1000 Independence Ave., SW, Washington, D.C. 20585

Office of Fissile Materials Disposition

Plutonium Disposition Alternatives

Fact Sheet

United States Department of Energy

IMMOBILIZATION CATEGORY

In this category of alternatives, surplus weapons-usable plutonium would be immobilized to create a chemically stable form for disposal in a domestic high level waste repository. The plutonium material may be mixed with high level waste or other radioactive isotopes and immobilized to create a radiation field that could serve as a proliferation deterrent.

Vitrification

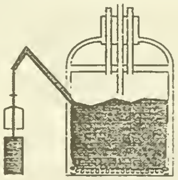
- The vitrification facility could receive plutonium in both metal or oxide forms
- Plutonium would be vitrified in borosilicate glass logs encased in stainless steel canisters.
- The vitrified borosilicate glass logs would remain onsite in vault-type storage until a final high level waste disposal site is operational

Ceramic Immobilization

- The ceramic immobilization facility could receive plutonium in both metal or oxide forms
- Plutonium would be immobilized in a titanate-based ceramic matrix encased in stainless steel canisters
- The ceramic immobilized forms would remain onsite in vault-type storage until a final high level waste disposal site is operational

Electrometallurgical Treatment

- The process can immobilize the plutonium into two waste forms: a glass-bonded zeolite and/or a corrosion resistant metal ingot
- The immobilized form would be placed in canisters for onsite storage until a final high level waste disposal site is operational.



Immobilization

For further information contact:
U.S. Department of Energy, Office of Fissile Materials Disposition, MD-4,
Forrestal Building, 1000 Independence Ave., SW, Washington, D.C. 20585

DEEP BOREHOLE CATEGORY

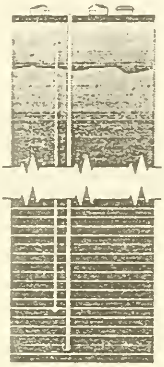
In this category of alternatives, surplus weapons-usable plutonium would be disposed of in deep boreholes that are drilled at least 2.5 miles into ancient, geologically stable rock formations beneath the water table. The deep borehole provides a geologic barrier against potential proliferation.

Direct Disposition

- Plutonium would be packaged and placed into metal emplacement canisters measuring 16 inches in diameter and 20 feet in length.
- The emplacement canisters would be sealed and placed between 1.2 and 2.5 miles into the deep boreholes.
- The deep boreholes would be sealed to isolate the plutonium from the accessible environment.

Immobilized Disposition

- A new ceramic immobilization facility could receive plutonium in both metal and oxide forms.
- Output of the immobilization facility would be ceramic pellets measuring 0.9 inches in diameter and length, and 1 percent plutonium by weight. Pellets would be packaged in emplacement canisters.
- The emplacement canisters would be sealed and placed between 1.2 and 2.5 miles into the deep boreholes.
- The deep boreholes would be sealed to isolate the plutonium from the accessible environment.



Deep Borehole

All plutonium disposition alternatives would require construction and operation of a pit disassembly/conversion facility and a plutonium conversion facility to transform the plutonium into forms suitable for treatment.

Each of the alternatives can be implemented in a number of ways. The representative case analyzed in the PEIS is presented here.

For further information contact:
U.S. Department of Energy, Office of Fissile Materials Disposition, MD-4,
Forrestal Building, 1000 Independence Ave., SW, Washington, D.C. 20585

Attachment A:

Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives

Attachment A

Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives

No Action S–63

Land Resources S–63

Site Infrastructure S–63

Air Quality and Noise S–64

Water Resources S–64

Geology and Soils S–65

Biological Resources S–65

Cultural and Paleontological Resources S–65

Socioeconomics S–65

Public and Occupational Health and Safety

Normal Radiological Impacts S–66

Hazardous Chemical Impacts S–67

Facility Accidents S–67

Waste Management S–68

Intersite Transportation of Fissile Materials S–68

Environmental Justice S–69

Upgrade Existing for Continued Storage of Plutonium and Highly Enriched Uranium With or Without Rocky Flats Environmental Technology Site Plutonium to Plutonium Storage Site Alternative S–70

Land Resources S–70

Site Infrastructure S–71

Air Quality and Noise S–72

Water Resources S–72

Geology and Soils S–73

Biological Resources S–74

Cultural and Paleontological Resources S–75
Socioeconomics S–76
Public and Occupational Health and Safety S–76
Normal Radiological Impacts S–76
Hazardous Chemical Impacts S–78
Facility Accidents S–78
Waste Management S–79
Intersite Transportation of Fissile Materials S–81
Environmental Justice S–81
Consolidate all Plutonium Material at One Site Using Upgraded and/or New Facility; Highly Enriched Uranium Remains at Oak Ridge Reservation S–82
Land Resources S–82
Site Infrastructure S–83
Air Quality and Noise S–83
Water Resources S–84
Geology and Soils S–86
Biological Resources S–87
Cultural and Paleontological Resources S–90
Socioeconomics S–91
Public and Occupational Health and Safety S–92
Normal Radiological Impacts S–92
Hazardous Chemical Impacts S–96
Facility Accidents S–97
Waste Management S–98
Intersite Transportation of Fissile Materials S–100
Environmental Justice S–100

Collocation of Plutonium with Highly Enriched Uranium Storage Facilities Upgrade and/or New Facility S–101

Land Resources S–101

Site Infrastructure S–103

Air Quality and Noise S–104

Water Resources S–105

Geology and Soils S–106

Biological Resources S–107

Cultural and Paleontological Resources S–110

Socioeconomics S–111

Public and Occupational Health and Safety S–112

Normal Radiological Impacts S–112

Hazardous Chemical Impacts S–116

Facility Accidents S–117

Waste Management S–118

Intersite Transportation of Fissile Materials S–120

Environmental Justice S–121

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action			
Land Resources						
There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.	There would be no impact to land use or visual resources.
The developed area of Hanford would remain VRM Class 5.	The developed area of NTS would remain VRM Class 5.	The developed area of INEL would remain VRM Class 5.	The developed area of Pantex would remain VRM Class 5.	The developed area of ORR would remain VRM Class 5.	The developed area of SRS would remain VRM Class 5.	The developed area of RFETS would remain VRM Class 5.
Site Infrastructure						
The peak electrical load would be 58 MWe during operation and the availability is 281 MWe. The projected use would be as follows:	NTS can handle all missions under the No Action alternative.	No change to baseline site infrastructure resources is anticipated. During operation projected use would be as follows:	A considerable reduction in site infrastructure requirements would occur. During operation projected use would be as follows:	Available resources are higher than projected usage. During operation projected use would be as follows:	No additional environmental impacts would occur to site infrastructure. During operation projected use would be as follows:	No additional environmental impacts would occur to site infrastructure. During operation projected use would be as follows:
EE: 345,500 MWh/yr	EE: 124,940 MWh/yr	EE: 232,500 MWh/yr	EE: 46,266 MWh/yr	EE: 820,000 MWh/yr	EE: 794,000 MWh/yr	EE: 184,000 MWh/yr
PEL: 58 MWe Fuel (oil/gas): 9,334,800 l/yr / 20,804,000 m^3/yr	PEL: 24.7 MWe Fuel (oil/gas): 5,715,367 l/yr / 0 m^3/yr.	PEL: 42 MWe Fuel (oil/gas): 5,820,000 l/yr / 0 m^3/yr.	PEL: 10 MWe Fuel (oil/gas): 795,166 l/yr / 7,200,000 m^3/yr.	PEL: 124 MWe Fuel (oil/gas): 379,000 l/yr / 99,000,000 m^3/yr.	PEL: 116 MWe Fuel (oil/gas): 28,400,000 l/yr / 0 m^3/yr.	PEL: 26 MWe Fuel (oil/gas): 8,140,000 l/yr / 18,600,000 m^3/yr.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Air Quality and Noise						
No change from existing conditions. Site is in compliance with ambient standards and guidelines.	No change from existing conditions. Site is in compliance with ambient standards and guidelines.	No chahge from existing conditions. Site is in compliance with ambient standards and guidelines.	No change from existing conditions. Site is in compliance with ambient standards and guidelines.	No change from existing conditions. Site is in compliance with ambient standards and guidelines.	No change from existing conditions. Site is in compliance with ambient standards and guidelines.	No change from existing conditions. Site is in compliance with ambient standards and guidelines.
No appreciable change in noise level would occur.	No appreciable change in noise level would occur.	No appreciable change in noise level would occur.	No appreciable change in noise level would occur.	No appreciable change in noise level would occur.	No appreciable change in noise level would occur.	No appreciable change in noise level would occur.
Water Resources						
Withdrawal would remain 13,511/ 195 MLY for surface/ground water during operations.	Withdrawal of 2,400 MLY of groundwater would continue from operations. No surface water would be used at NTS.	Withdrawal of 7,570 MLY of groundwater would continue for operations. No surface water would be used at INEL.	Withdrawal of 249 MLY of groundwater would continue for operations. No surface water would be used at Pantex.	Withdrawal of 14,760 MLY of water would continue from surface water. No groundwater would be used at ORR for this mission.	Withdrawal of 13,247 MLY of water would continue from groundwater. Surface water withdraw would remain at 127,000 MLY.	Withdrawal of 439 MLY of water would continue to be obtained from municipal water supplies.
Quantities of wastewater (246 MLY) would continue to be generated and would be discharged to evaporation/ infiltration ponds.	Quantities of wastewater (82 MLY) would continue to be generated and would be discharged to evaporation/ infiltration ponds.	Quantities of wastewater (540 MLY) would continue to be generated and would be discharged to evaporation/ infiltration ponds.	Quantities of wastewater (141 MLY) would continue to be generated and would be discharged to the playas.	Quantities of wastewater (2,277 MLY) would continue to be generated, treated, would be discharged to near-by streams.	Quantities of wastewater (700 MLY) would continue to be generated, treated, would be discharged to near-by streams.	Quantities of wastewater (130 MLY) would continue to be generated, treated, would be discharged to near-by streams. Groundwater remediation removals should decrease from 10.6 MLY to 7.8 MLY.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Geology and Soils						
There would be no impact to geology and soil.	There would be no impact to geology and soil.	There would be no impact to geology and soil.	There would be no impact to geology and soil.	There would be no impact to geology and soil.	There would be no impact to geology and soil.	There would be no impact to geology and soil.
Biological Resources						
There would be no impact to biotic resources.	There would be no impact to biotic resources.	There would be no impact to biotic resources.	There would be no impact to biotic resources.	There would be no impact to biotic resources.	There would be no impact to biotic resources.	There would be no impact to biotic resources.
Cultural and Paleontological Resources						
There would be no impact to cultural and paleontological resources.	There would be no impact to cultural and paleontological resources.	There would be no impact to cultural and paleontological resources.	There would be no impact to e cultural and paleontological resources.	There would be no impact to cultural and paleontological resources.	There would be no impact to cultural and paleontological resources.	There would be no impact to cultural and paleontological resources.
Socioeconomics						
Employment in the economic study area is expected to grow about 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow a little more than 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow about 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow less than 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow less than 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow less than 1 percent annually to the year 2040.	Employment in the economic study area is expected to grow about 1 percent annually to the year 2040.
Local transportation would not be affected.	Local transportation would not be affected.	Local transportation would not be affected.	Local transportation would not be affected.	Local transportation would not be affected.	Local transportation would not be affected.	Local transportation would not be affected.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Public and Occupational Health and Safety						
Normal Radiological Impacts						
The annual dose to the MEI of the public would be 5.5×10^{-3} mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 1.4×10^{-7}.	The annual dose to the MEI of the public would be 4.2×10^{-3} mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 1.0×10^{-7}.	The annual dose to the MEI of the public would be 0.018 mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 4.4×10^{-7}.	The annual dose to the MEI of the public would be 6.1×10^{-5} mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 1.5×10^{-9}.	The annual dose to the MEI of the public would be 3.2 mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 8.0×10^{-5}.	The annual dose to the MEI of the public would be 0.79 mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 2.0×10^{-5}.	The annual dose to the MEI of the public would be 0.48 mrem. The estimated risk of fatal cancer for the MEI from 50 years of operations would be 1.2×10^{-5}.
The annual total dose to the public would be 1.5 person-rem. The estimated projected number of fatal cancers to the public is 0.039 as the result of 50 years of operation.	The annual total dose to the public would be 2.5×10^{-3} person-rem. The estimated projected number of fatal cancers to the public is 6.3×10^{-5} as the result of 50 years of operation.	The annual total dose to the public would be 2.4 person-rem. The estimated projected number of fatal cancers to the public is 0.061 as the result of 50 years of operation.	The annual total dose to the public would be 2.7×10^{-4} person-rem. The estimated projected number of fatal cancers to the public is 6.8×10^{-6} as the result of 50 years of operation.	The annual total dose to the public would be 30 person-rem. The estimated projected number of fatal cancers to the public is 0.75 as the result of 50 years of operation.	The annual total dose to the public would be 134 person-rem. The estimated projected number of fatal cancers to the public is 3.4 as the result of 50 years of operation.	The annual total dose to the public would be 0.10 person-rem. The estimated projected number of fatal cancers to the public is 2.5×10^{-3} as the result of 50 years of operation.
The average annual dose to the site worker would be 27 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 5.5×10^{-4}.	The average annual dose to the site worker would be 5.0 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 1.0×10^{-4}.	The average annual dose to the site worker would be 30 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 6.0×10^{-4}.	The average annual dose to the site worker would be 15 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 3.0×10^{-4}.	The average annual dose to the site worker would be 2.6 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 5.2×10^{-5}.	The average annual dose to the site worker would be 32 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 6.5×10^{-4}.	The average annual dose to the site worker would be 125 mrem. The fatal cancer risk for this worker from 50 years of operation is estimated to be 2.5×10^{-3}.
The total annual dose to the site workforce would be 250 person-rem which would cause an estimated 5.1 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 3.0 person-rem which would cause an estimated 0.060 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 220 person-rem which would cause an estimated 4.4 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 37 person-rem which would cause an estimated 0.74 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 44 person-rem which would cause an estimated 0.88 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 480 person-rem which would cause an estimated 9.6 fatal cancers from 50 years of operations.	The total annual dose to the site workforce would be 800 person-rem which would cause an estimated 16 fatal cancers from 50 years of operations.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Public and Occupational Health and Safety (continued)						
Hazardous Chemical Impacts						
The HI and cancer risk for public/ worker are as follows: 6.2×10^{-5} and 0 / 3.99×10^{-3} and 0.	The HI and cancer risk for public/ worker are as follows: 0 and 0/ 0 and 0.	The HI and cancer risk for public/ worker are as follows: 1.53×10^{-2} and 3.64×10^{-6} / 0.223 and 7.69×10^{-4}.	The HI and cancer risk for public/ worker are as follows: 5.65×10^{-3} and 1.10×10^{-8}/ 6.14×10^{-3} and 4.48×10^{-7}.	The HI and cancer risk for public/ worker are as follows: 3.95×10^{-2} and 0/ 0.152 and 0.	The HI and cancer risk for public/ worker are as follows: 9.38×10^{-1} and 3.34×10^{-5} / 8.51 and 4.94×10^{-2}.	The HI and cancer risk for public/ worker are as follows: 1.17×10^{-3} and 2.1×10^{-8}/ 1.33×10^{-2} and 2.34×10^{-6}.
Facility Accidents						
Pu storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	No change to non-storage facilities and operations would occur. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	Pu storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	Pu storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	HEU storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	Pu storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.	Pu storage would continue to be performed at the site with no change to facilities and operations. Under existing conditions, potential accidents and their consequences have previously been addressed and documented according to requirements in DOE Orders.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Waste Management						
TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at Hanford. No impact to current waste management activities would occur.	Low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at NTS. No impact to current waste management activities would occur.	TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at INEL. No impact to current waste management activities would occur.	Low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at Pantex. No impact to current waste management activities would occur.	TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at ORR. No impact to current waste management activities would occur.	TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed at SRS. No impact to current waste management activities would occur.	TRU, low-level, mixed, hazardous, nonhazardous wastes would continue to be managed at RFETS. No impact to current waste management activities would occur.
Generation levels for liquid /solid would be as follows:	Generation levels for liquid/solid would be as follows:	Generation levels for liquid/solid would be as follows:	Generation levels for liquid/solid would be as follows:	Generation levels for liquid/solid would be as follows:	Generation levels for liquid/solid would be as follows:	Generation levels for liquid/solid would be as follows:
TRU: 0/271 m^3	TRU: 0/0 m^3	TRU: 0/less than1 m^3	TRU: 0/0 m^3	TRU: 0/119 m^3	TRU: 0/338 m^3	TRU: 0/11 m^3
Mixed TRU: 0/98 m^3	Mixed TRU: 0/0 m^3	Mixed TRU: Included in TRU	Mixed TRU: 0/0 m^3	Mixed TRU: 0/0 m^3	Mixed TRU: Included in TRU	Mixed TRU: 0/18 m^3
LLW: 0/3,390 m^3	LLW: dependant on restoration activities/34 m^3	LLW: 0/3,900 m^3	LLW: 1/19 m^3	LLW: 3,500/9,150 m^3	LLW: 74,000/ 16,400 m^3	LLW: 0/1,160 m^3
Mixed LLW: 3,760/ 1,505 m^3	Mixed LLW: included in solid/less than 0.01 m^3	Mixed LLW: 0/ 164 m^3	Mixed LLW: less than 1/4 m^3	Mixed LLW: 93,100/ 594 m^3	Mixed LLW: 1,330/ 7,970 m^3	Mixed LLW: 0/69 m^3
HAZ: See solid/ 560 m^3	HAZ: 29/15 m^3	HAZ: 0/235 m^3	HAZ: 2/31 m^3	HAZ: 6,440/26 m^3	HAZ: 1,260/15,100 m^3	HAZ: 0/2 m^3
Nonhaz (sanitary): Not available/ 5,107 m^3	Nonhaz (sanitary): included in solid/ 5,350 m^3	Nonhaz (sanitary): included in solid/ 52,000 m^3	Nonhaz (sanitary): 141,000 / 339 m^3	Nonhaz (sanitary): 1,660,000/ 76,200 m^3	Nonhaz (sanitary): 703,000/ 61,200 m^3	Nonhaz (sanitary): 207,000/ 12,500 m^3
Intersite Transportation of Fissile Materials						
No material would be transported, so no transportation risks would be incurred.	No material would be transported, so no transportation risks would be incurred.	No material would be transported, so no additional transportation risks would be incurred.	No material would be transported because Pantex does not have a LLW processing facility, so no transportation risks would be incurred.	No material would be transported, so no transportation risks would be incurred.	No material would be transported, so no transportation risks would be incurred.	No material would be transported, so no transportation risks would be incurred.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
			No Action (continued)			
Environmental Justice						
Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Because of the high percent of minority and low-income population surrounding SRS, the potential exists for these populations to be disproportionately affected by an accident causing a radiological release.	Impacts would not disproportionately affect minority or low-income populations.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative						
Land Resources						
Upgrade of existing FMEF with/without RFETS material would not cause additional land disturbance during construction nor would additional land be used during operation. Construction of a new Pu storage facility with/without RFETS material, would cause land disturbance of 58.5 ha during construction of which 56 ha would be used during operation.	This alternative does not apply to NTS.	Upgrade of existing ANL-W facility with/without RFETS material would disturb 3.7 ha/3.7 ha of land area of which 1.7 ha/1.7 ha would be used during construction operation. A minimum 1.6-km (1-mi) buffer zone exists between the ANL-W upgrade operations and the INEL site boundary.	Upgrade of existing facility with/without RFETS material, would disturb 2.6 ha/0.185 ha of land area during construction of which 0.1 ha/0.1 ha would be used during operation. As an existing facility, a buffer zone is established.	Existing plant facilities would be upgraded with no modifications of the exterior of the facility. Land area would not be disturbed. As an existing facility, a buffer zone is established.	Construction of a new F-area facility with/without RFETS material would disturb 4 ha/2 ha during construction of which 2 ha/2 ha would be used during operation. As an existing facility, a 1.6 km (1 mi) buffer zone is established.	This alternative does not apply to RFETS.
All subalternatives would be consistent with the current Class 5 VRM designation.	This alternative does not apply to NTS.	All subalternatives would be consistent with the current Class 5 VRM designation.	All subalternatives would be consistent with the current Class 5 VRM designation.	The alternative would be consistent with the current Class 5 VRM designation.	All subalternatives would be consistent with the current Class 5 VRM designation.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Site Infrastructure						
During construction, impacts to site infrastructure are minimal. Operational impacts for upgrade of all subalternatives with RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	This alternative does not apply to NTS.	Construction and operation requirement would constitute a small change in resource requirement. Operational impacts for upgrade with RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	During construction small change in requirements. Highest percentage increase over no action would be for oil. Operational impacts for upgrade with RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 5.4 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	This alternative does not apply to ORR.	Construction and operational impacts would be minimal for site infrastructure resource. Operational impacts for upgrade with RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 23,620 l/yr / 0 m^3/yr	This alternative does not apply to RFETS.
During construction, impacts to site infrastructure are minimal. Operational impacts for upgrade for all subalternatives without RFETS material would increase site infrastructure needs as follows. EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	This alternative does not apply to NTS	During construction, impacts to site infrastructure are minimal. Operational impacts for upgrade without RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	During construction, impacts to site infrastructure are minimal. Operational impacts for upgrade without RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	There would be little or no affect on site infrastructure impacts during construction. Operational impacts for upgrade would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr	During construction, impacts to site infrastructure are minimal. Operational impacts for upgrade without RFETS material would increase site infrastructure needs as follows: EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 23,620 l/yr / 0 m^3/yr	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Air Quality and Noise						
During construction, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to NTS.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.
During operation for all upgrade subalternatives, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to NTS.	During operation for all upgrade subalternatives, site is expected to comply with ambient air standards and guidelines.	During operation for all upgrade subalternatives, site is expected to comply with ambient air standards and guidelines.	During operation for all upgrade subalternatives, site is expected to comply with ambient air standards and guidelines.	During operation for all upgrade subalternatives, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.
No appreciable change in offsite noise levels would occur.	This alternative does not apply to NTS.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	This alternative does not apply to RFETS.
Water Resources						
The total percent increase in surface water use and discharge for new storage and (FMEF) options, with/without RFETS material during construction would be 0.04/0.04 (3.1/2.6), and 1.9/1.6 (1.9/1.6).	This alternative does not apply to NTS.	The total percent increase in surface water use and discharge with/without RFETS material during construction would be 0.2/0.1 and 0.01/0.01.	The total percent increase in groundwater use and discharge with/without RFETS material during construction would be 33/2.6 and 5.8/2.1.	The total percent increase in surface water use and discharge during construction would be 0.02 and 0.07.	The total percent increase in groundwater use and discharge with/without RFETS material during construction would be 0.06/0.05 and 0.7/0.7. No surface water would be used for this alternative.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Water Resources (continued)						
The total percent increase in groundwater use for the new storage and (FMEF) options and discharge with/without RFETS material during operation would be 0.07/0.06 (4.5/4.3) and 3.6/3.4 (3.6/3.4).	This alternative does not apply to NTS.	The total percent increase in surface water use and discharge with/without RFETS material during operation would be 0.3/0.2 and discharge would be recycled.	The total percent increase in groundwater use and discharge with/without RFETS material during operation would be 44.2/1.6 and 0/2.6.	The total percent increase in surface water use and discharge during operation would be 0.002 and 0.00009.	The total percent increase in groundwater use and discharge with/without RFETS material during operation would be 0.2/0.2 and 1.1/0.9.	This alternative does not apply to RFETS.
No construction or operation will take place in the 100-year or 500-year floodplain.	This alternative does not apply to NTS.	No construction or operation will take place in the 100-year or 500-year floodplain.	No construction or operation will take place in the 100-year or 500-year floodplain.	No construction or operation will take place in the 100-year or 500-year floodplain.	No construction or operation will take place in the 100-year floodplain.	This alternative does not apply to RFETS.
Geology and Soils						
Construction and operation would not affect the geological conditions for all upgrade options.	This alternative does not apply to NTS.	Construction and operation would not affect the geological conditions for all upgrade options.	Construction and operation would not affect the geological conditions for all upgrade options.	Construction and operation would not affect the geological conditions for all upgrade options.	Construction and operation would not affect the geological conditions for all upgrade options.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Geology and Soils (continued)						
Soil erosion due to wind and stormwater would be minor for all upgrade options.	This alternative dose not apply to NTS.	Soil erosion due to wind and stormwater would be minor for all upgrade options.	Soil erosion due to wind and stormwater would be minor for all upgrade options.	Soil erosion due to wind and stormwater would be minor for all upgrade options.	Soil erosion due to wind and stormwater would be minor for all upgrade options.	This alternative does not apply to RFETS.
Biological Resources						
Construction and operation would have minimal impact on biological resources because upgrade would take place on disturbed areas of the site for FMEF and the new storage facility.	This alternative does not apply to NTS.	Construction and operation would have minimal impact on biological resources because upgrade would take place on disturbed areas of the site.	Construction and operation would have minimal impact on biological resources because upgrade would take place on disturbed areas of the site.	Construction and operation would have minimal impact on biological resources because upgrade would take place on disturbed areas of the site.	Construction and operation would have minimal impact on biological resources because upgrade would take place on disturbed areas of the site. New facility will be built on disturbed land.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Cultural and Paleontological Resources						
It is unlikely that NRHP-eligible prehistoric and historic resources occur within the 58.5 ha that would be disturbed during construction. Operation would not result in additional impact. No impact would occur as a result of modifying or operating the FMEF.	This alternative does not apply to NTS.	It is unlikely that NRHP-eligible prehistoric and historic resources occur within the 3.7 ha that would be disturbed during construction. Operation would not result in additional impact.	NRHP-eligible prehistoric and historic resources occur within the acreage that would be disturbed during construction. Operation would not result in additional impact.	Building modifications are proposed for 4 NRHP eligible resources.	Some NRHP-eligible prehistoric and historic resources may occur within the 4 ha that would be disturbed during construction. Operation would not result in additional impact.	This alternative does to apply to RFETS.
Some Native American resources may be affected by construction and operation of the Pu storage facility.	This alternative does not apply to NTS.	Some Native American resources may be affected by construction and operation of the Pu storage facility.	It is unlikely that Native American resources would be affected by construction or operation.	It is unlikely that Native American resources would be affected by construction or operation.	It is unlikely that Native American resources would be affected by construction or operation.	This alternative does to apply to RFETS.
Some paleontological resources may be affected by construction.	This alternative does not apply to NTS.	Paleontological resources may be affected by construction.	It is unlikely that paleontological resources occur within the acreage disturbed during construction.	No activity is planned that would affect paleontological resources.	SRS does not contain scientifically valuable paleontological remains.	This alternative does to apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Socioeconomics						
During peak construction/ operation total employment would increase by much less than 1 percent.	This alternative does not apply to NTS.	During peak construction/ operation total employment would increase by less than 1 percent over No Action.	During peak construction/ operation total employment would increase by less than 1 percent over No Action.	During peak construction/ operation total employment would increase by much less 1 percent over No Action.	During peak construction/ operation total employment would increase by less than 1 percent over No Action.	This alternative does not apply to RFETS.
Local transportation would not change appreciably.	This alternative does not apply to NTS.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	This alternative does not apply to RFETS.
Public and Occupational Health and Safety						
Normal Radiological Impacts						
The annual dose from the upgraded storage facility to the public and the estimated risk of fatal cancer are expected to be essentially the same as for storage under the No Action Alternative.	This alternative does not apply to NTS.	The annual dose from the upgraded storage facility to the public and the estimated risk of fatal cancer are expected to be essentially the same as for storage under the No Action Alternative.	The annual dose from the upgraded storage facility to the public and the estimated risk of fatal cancer are expected to be essentially the same as for storage under the No Action Alternative.	The annual dose from the upgraded storage facility to the public and the estimated risk of fatal cancer are expected to be essentially the same as for storage under the No Action Alternative.	The annual dose from the upgraded storage facility to the public and the estimated risk of fatal cancer are expected to be essentially the same as for storage under the No Action Alternative.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	This alternative does not apply to NTS.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	This alternative does not apply to RFETS.
The average annual dose from the upgraded storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be 5.0×10^{-3} from 50 years of operation.	This alternative does not apply to NTS.	The average annual dose from the upgraded storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be 5.0×10^{-3} from 50 years of operation.	The average annual dose from the upgraded storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be 5.0×10^{-3} from 50 years of operation.	The average annual dose from the upgraded storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be 5.0×10^{-3} from 50 years of operation.	The average annual dose from the upgraded storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be 5.0×10^{-3} from 50 years of operation.	This alternative does not apply to RFETS.
The annual dose from the upgraded storage facility to the total involved workforce would be 52 person-rem which would result in an estimated 1.0 fatal cancer from 50 years of operations.	This alternative does not apply to NTS.	The annual dose from the upgraded storage facility to the total involved workforce would be 16 person-rem which would result in an estimated 0.32 fatal cancer from 50 years of operations.	The annual dose from the upgraded storage facility to the total involved workforce would be 37 person-rem which would result in an estimated 0.74 fatal cancer from 50 years of operations.	The annual dose from the upgraded storage facility to the total involved workforce would be 14 person-rem which would result in an estimated 0.28 fatal cancer from 50 years of operations.	The annual dose from the upgraded storage facility to the total involved workforce would be 39 person-rem which would result in an estimated 0.78 fatal cancer from 50 years of operations.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Public and Occupational Health and Safety (continued)						
Hazardous Chemical Impacts						
The HI and cancer risk for public/ worker would be: $9.35x10^{-7}$ and 0/ $1.89x10^{-5}$ and 0.	This alternative does not apply to NTS.	The HI and cancer risk for public/ worker would be: $1.13x10^{-5}$ and $2.67x10^{-8}$/ $3.41x10^{-4}$ and $5.65x10^{-6}$	The HI and cancer risk for public/ worker would be: 0 and 0/ 0 and 0.	The HI and cancer risk for public/ worker would be: $8.6x10^{-5}$ and 0/ $5.73x10^{-4}$ and 0.	The HI and cancer risk for public/ worker would be: $1.49x10^{-6}$ and 0/ $2.15x10^{-4}$ and 0.	This alternative does not apply to RFETS.
Facility Accidents						
Pu storage facilities would be brought into compliance with applicable DOE orders and other regulations and standards. This may result in a reduction of risk compared to No Action.	This alternative does not apply to NTS.	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be: New facility probability of cancer/risk to worker: 0.020/ $1.0x10^{-7}$ MEI: $9.8x10^{-4}$/ $4.9x10^{-7}$ Population: Number of cancer fatalities: 0.25 Cancer fatalities risk: $1.3x10^{-6}$	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be: New facility probability of cancer/risk to worker: $5.7x10^{-3}$/ $2.9x10^{-8}$ MEI: $2.1x10^{-7}$/ $1.1x10^{-8}$ Population: Number of cancer fatalities: 0.24 Cancer fatalities risk: $1.2x10^{-6}$	HEU storage facilities would be brought into compliance with applicable DOE orders and other regulations and standards. This may result in a reduction of risk compared to No Action.	Pu storage facilities would be brought into compliance with applicable DOE orders and other regulations and standards. This may result in a reduction of risk compared to No Action.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site.
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Waste Management						
During construction and operation all categories of waste would be managed at Hanford.	This alternative does not apply to NTS.	During construction and operation all categories of waste would be managed at INEL.	During construction and operation all categories of waste would be managed at Pantex.	During construction and operation all categories of waste would be managed at ORR.	During construction and operation all categories of waste would be managed at SRS.	This alternative does not apply to RFETS.
The net increase in generation due to upgrade with RFETS material for liquid/solid would be as follows:	This alternative does not apply to NTS.	The net increase in generation due to upgrade with RFETS material for liquid/solid would be as follows:	This is bounded by the Consolidation Alternative.	The net increase in generation due to upgrade (HEU only) for liquid/solid would be as follows:	The net increase/ decrease in generation due to upgrade with RFETS material for liquid/solid would be as follows:	This alternative does not apply to RFETS.
TRU: 0/21 m^3		TRU: 0/2 m^3		TRU: 0/0 m^3	TRU: 0/8 m^3	
Mixed TRU: 0/0 m^3		Mixed TRU: 0/1 m^3		Mixed TRU: 0/0 m^3	Mixed TRU: 0/0 m^3	
LLW: less than 0.1/ 89 m^3		LLW: less than 0.1/ 500 m^3		LLW: less than 0.1/ 3 m^3	LLW: less than 1/ -28 m^3	
Mixed LLW: 0/5 m^3		Mixed LLW: less than 0.1/27 m^3		Mixed LLW: less than 0.1/less than 1 m^3	Mixed LLW: 0/2 m^3	
HAZ: less than 1/4 m^3		HAZ: less than 1/1 m^3		HAZ: included in Mixed LLW	HAZ: less than 1/1 m^3	
Nonhaz: 8,780/ 967 m^3		Nonhaz: 21,950/ 180 m^3		Nonhaz: less than 1/31 m^3	Nonhaz: -11,170/ -1,220 m^3	

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Waste Management (continued)						
The net increase in generation due to upgrade without RFETS material for liquid/solid would be as follows:	This alternative does not apply to NTS.	The net increase in generation due to upgrade without RFETS material for liquid/solid would be as follows:	The net increase in generation due to upgrade without RFETS material for liquid/solid would be as follows:	This alternative does not apply to ORR.	The net increase/ decrease in generation due to upgrade without RFETS material for liquid/solid would be as follows:	This alternative does not apply to RFETS.
TRU: 0/20 m^3		TRU: 0/2 m^3	TRU: less than 0.1/ less than 1 m^3		TRU: 0/8 m^3	
Mixed TRU: 0/0 m^3		Mixed TRU: 0/1 m^3	Mixed TRU: 0/0 m^3		Mixed TRU: 0/0 m^3	
LLW: less than 1/ 85 m^3		LLW: less than 0.1/ 500 m^3	LLW: less than0.1/ 138 m^3		LLW: less than 1/ -28 m^3	
Mixed LLW: 0/5 m^3		Mixed LLW: less than 0.1/27 m^3	Mixed LLW: less than 1/8 m^3		Mixed LLW: 0/2 m^3	
HAZ: less than 1/4 m^3		HAZ: less than 1/ 1 m^3	HAZ: 1/2 m^3		HAZ: less than 1/ 1 m^3	
Nonhaz: 8,330/ 917 m^3		Nonhaz: 17,230/ 120 m^3	Nonhaz: 12,900/ 275 m^3		Nonhaz: -12,660/ -1,728 m^3	

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Upgrade Existing Facility for Continued Storage of Pu and HEU; With or Without RFETS Pu to Pu Storage Site Alternative (continued)						
Intersite Transportation of Fissile Materials						
Transport of all materials to Hanford would have maximum potential fatalities of 0.044.	This alternative does not apply to NTS.	Transport of all materials to INEL would have maximum potential fatalities of 0.028.	Transport of all materials to PANTEX would have maximum potential fatalities of 0.029.	HEU would continue to be stored, no additional material would be transported.	Transport of all materials to SRS would have maximum potential fatalities of 0.077.	The risk associated with transport of RFETS materials would have a range between 0.028 and 0.077.
No intersite transportation of RFETS material would occur causing no impacts.	This alternative does not apply to NTS.	No intersite transportation of RFETS material would occur causing no impacts.	No intersite transportation of RFETS material would occur causing no impacts.	HEU would continue to be stored, no additional material would be transported.	No intersite transportation of RFETS material would occur causing no impacts.	The risk associated with transport of RFETS materials have been included in respective storage sites.
Environmental Justice						
Impacts would not disproportionately affect minority or low-income populations.	This alternative does not apply to NTS.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Because of the high percent of minority and low-income population surrounding SRS, the potential exists for these populations to be disproportionately affected by an accident causing a radiological release.	This alternative does not apply to RFETS.

Attachment A. ***Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued***

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR						
Land Resources						
New consolidated facility for Pu storage would disturb 58.5 ha of land area during construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the Hanford site boundary.	New storage facility would disturb 58.5 ha of land area during construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the NTS site.	New storage facility would disturb 58.5 ha of land during construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the INEL site boundry.	New storage facility would disturb 58.5 ha of land area during construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the Pantex site boundry.	This alternative dose not apply to ORR.	New storage facility would disturb 58.5 ha during construction of which 56 ha would be used using operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the SRS site boundry.	This alternative does not apply to RFETS.
This option does not apply at Hanford.	Modification of existing P-Tunnel would disturb 25 ha of land during construction of which 20 ha would be used during operation. As a modification of an existing facility, the 1.6-km (1-mi) buffer zone is established.	This option does not apply at INEL.	Construction of new and modification of existing buildings would disturb 60.5 ha of land during construction of which 58 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the Pantex site boundry.	This option does not apply at ORR.	This option does not apply at SRS.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR						
Land Resources (continued)						
The alternative would be consistent with the current VRM Class 5 designation.	The subalternatives would be consistent with the current VRM Class 5 designation.	The alternative would be consistent with the current VRM Class 5 designation.	All subalternatives would be consistent with the current VRM Class 5 designation.	This alternative does not apply to ORR.	The current VRM designation would change from Class 4 to Class 5 under this alternative.	This alternative does not apply to RFETS.
Site Infrastructure						
No impacts from construction would occur. Operation would increase site infrastructure by:	Natural gas and peak load would be most impacted by the consolidation option. About 5 million m^3 of Natural gas would be required. Operational impacts would increase site infrastructure as follows (P-Tunnel/ new facility):	Construction requirements would constitute a small change in site resource requirements. Operational impacts would increase site infrastructure as follows:	Oil would have the highest increase over No Action but would not exceed available site resources. Operational impacts would increase site infrastructure as follows (new facility/upgrade):	This alternative dose not apply to ORR.	Construction requirements would constitute a small change in site resource requirements. Operational requirement would be slightly greater with a peak load of 126 MWe. Operational impacts would increase site infrastructure as follows:	This alternative does not apply to RFETS.
EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): all requirements are below site availability.	EE: 0/20,096 MWh/yr PEL: 0/0 MWe Fuel (oil/gas): 38,000/ 3,200,000 l/yr (38,000/ 2,831,700 m^3/yr)	EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr.	EE: 0/0 MWh/yr PEL: 4.4/5.4 MWe Fuel (oil/gas): 0/0 l/yr / 0/0 m^3/yr.		EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 45,000 l/yr / 0 m^3/yr.	
Air Quality and Noise						
During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	This alternative dose not apply to ORR.	During construction, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Air Quality and Noise (continued)						
During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines for both subalternatives.	This alternative dose not apply to ORR.	During operation, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.
No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	This alternative dose not apply to ORR.	No appreciable change in offsite noise levels would occur.	This alternative does not apply to RFETS.
Water Resources						
The total percent increase in surface water use and discharge during construction would be 0.6 and 3.1.	The total percent increase in groundwater for P-Tunnel/new facility and discharge use during construction would be 1.5/3.4 and 9.5/9.2. No surface water would be used for this option.	The total percent increase in groundwater use and discharge during construction would be 1.1 and 0.01. No surface water would be used for this option.	The total percent increase in groundwater use and discharge for new facility/upgrade, during construction, would be 33/33 and 5.8/5.8. No surface water would be used for this option.	This alternative dose not apply to ORR.	The total percent increase in groundwater use and discharge during construction would be 0.6 and 1.2. No surface water would be used for this option.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Water Resources (continued)						
The total percent increase in surface water use and discharge during operation would be 0.8 and 0.	The total percent increase in groundwater use during operation would be 5.6/4.6. No surface water would be used. Discharge would be recycled.	The total percent increase in groundwater use during operation would be 0.9. No surface water would be used. Discharge would be recycled.	The total percent increase in groundwater use during operation would be 39.4/44.2. No surface water would be used. Discharge would be recycled.	This alternative dose not apply to ORR.	The total percent increase in groundwater use and discharge during operation would be 2.7 and 24.1.	This alternative does not apply to RFETS.
No construction or operation will take place in the 100-year or 500-year floodplains.	No construction or operation will take place in the 100- and 500-year floodplain.	No construction or operation will take place in the 100- and 500-year floodplains.	No construction or operation will take place in the 100-year or 500-year floodplains.	This alternative dose not apply to ORR.	No construction or operation will take place in the 100-year floodplain.	This alternative does not apply to RFETS.

Attachment A. *Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued*

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Geology and Soils						
Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	This alternative dose not apply to ORR.	Construction and operation would not affect the geological conditions.	This alternative does not apply to RFETS.
Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	This alternative dose not apply to ORR.	Soil erosion due to wind and stormwater would be minor.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Biological Resources						
Construction and operation would disturb 58.5 ha (0.04 percent of Hanford) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 58.5 ha (less than 0.02 percent of NTS) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 58.5 ha (less than 0.03 percent of INEL) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 60.5/58.5 ha (2 percent of Pantex) for upgrade/new facility, respectively, of terrestrial habitat. Construction would have some adverse effects on animal populations.	This alternative dose not apply to ORR.	Construction and operation would disturb 58.5 ha (less than 0.07 percent of SRS) of terrestrial habitat. Construction would have some adverse effects on animal populations.	This alternative does not apply to RFETS.
	P-Tunnel would have minimal impact because construction would take place on disturbed area.					
Impacts from cooling towers would not be expected since salt drift would be minimal.	Dry cooling towers would preclude impacts from salt drift.	Dry cooling towers would preclude impacts from salt drift.	Dry cooling towers would preclude impacts from salt drift.	This alternative dose not apply to ORR.	Impacts from cooling towers would not be expected since salt drift would be minimal.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Biological Resources (continued)						
Construction and operation would have minimal effect on wetlands and aquatic resources.	Construction and operation would not affect wetland and aquatic resources.	Construction and operation would not affect wetlands and aquatic resources.	Construction-related ground disturbance may increase the potential for sediment runoff to wetlands. During construction and operation, discharge of treated wastewater could cause increase open water areas in site playas which could lead to change in plant community composition. Discharges should increase aquatic habitat for amphibians.	This alternative does not apply to ORR.	During construction and operation there would be minimal effect on wetlands and aquatic resources.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Biological Resources (continued)						
Federal-listed threatened and endangered species would not be affected. A number of Federal and State candidate species could lose breeding and/or foraging habitat.	The desert tortoise is the only Federal-listed species that could be affected during construction and operation. Several Federal candidate species could lose breeding and/or foraging areas. P-Tunnel option would not impact the desert tortoise.	Federal-listed threatened and endangered species would not be affected. Several Federal candidate and State-listed species may lose breeding and foraging habitat.	Bald eagle is the only Federal-listed species that could be affected during construction. Several Federal candidate species may also be affected during construction and operation.	This alternative does not apply to ORR.	Federal-listed threatened and endangered species would not be affected. Several special status species could be affected by construction due to a loss of habitat.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Cultural and Paleontological Resources						
Some NRHP-eligible prehistoric and historic resources may occur within the 58.5 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 58.5 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 58.5 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources occur within the 58.5 (new facility) or 60.5 ha (modification and new facility) that would be disturbed during construction. Operation would not result in additional impact.	This alternative does not apply to ORR.	Some NRHP-eligible prehistoric and historic resources may occur within the 58.5 ha that would be disturbed during construction. Operation would not result in additional impact.	This alternative does not apply to RFETS.
	For P-Tunnel option, some NRHP-eligible prehistoric and historic resources may occur in the 25 ha to be disturbed during construction. Operation would not result in additional impact.					
Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.	It is unlikely that Native American resources would be affected by construction and operation.	This alternative does not apply to ORR.	It is unlikely that Native American resources would be affected by construction and operation.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Cultural and Paleontological Resources (continued)						
Some paleontological resources may be affected by construction.	Some paleontological resources may be affected by construction.	Some paleontological resources may be affected by construction.	It is unlikely that paleontological resources occur within the acreage disturbed during construction.	This alternative does not apply to ORR.	SRS does not contain scientifically valuable paleontological remains.	This alternative does not apply to RFETS.
Socioeconomics						
During peak construction/ operation employment would increase less than 1 percent over No Action.	During peak construction/ operation employment would increase less than 1 percent over No Action.	During peak construction/ operation employment would increase about 1 percent increase over No Action.	During peak construction/ operation employment would increase less than 1 percent over No Action.	This alternative does not apply to ORR.	During peak construction/ operation employment would increase less than 1 percent over No Action.	This alternative does not apply to RFETS.
Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would change from free flow to a restricted condition.	This alternative does not apply to ORR.	Local transportation would not change appreciably.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety						
Normal Radiological Impacts						
The annual dose from the consolidated storage facility to the MEI of the public would be $2.6x10^{-6}$ mrem, and the estimated risk of fatal cancer would be $6.5x10^{-11}$ from 50 years of operations.	The annual dose from the consolidated storage facility to the MEI of the public for the new facility would be $1.3x10^{-6}$ mrem, and the estimated risk of fatal cancer would be $3.2x10^{-11}$ from 50 years of operations.	The annual dose from the consolidated storage facility to the MEI of the public would be $1.7x10^{-6}$ mrem, and the estimated risk of fatal cancer would be $4.3x10^{-11}$ from 50 years of operations.	The annual dose from the consolidated storage facility to the MEI of the public for the New Facility would be $9.7x10^{-6}$ mrem, and the estimated risk of fatal cancer would be $2.4x10^{-10}$ from 50 years of operations.	This alternative does not apply to ORR.	The annual dose from the consolidated storage facility to the MEI of the public would be $1.5x10^{-5}$ mrem, and the estimated risk of fatal cancer would be $3.8x10^{-10}$ from 50 years of operations.	This alternative does not apply to RFETS.
	The annual dose from the consolidated storage facility to the MEI of the public for the upgraded P-Tunnel would be $5.6x10^{-6}$ mrem, and the estimated risk of fatal cancer would be $1.4x10^{-10}$ from 50 years of operations.		The annual dose from the consolidated storage facility to the MEI of the public for upgrade of the existing facility would be $9.5x10^{-6}$ mrem, and estimated risk of fatal cancer would be $2.4x10^{-10}$ from 50 years of operation.			

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The annual dose from the consolidated storage facility to the public would be 8.7×10^{-5} person-rem. This would result in an estimated 2.2×10^{-6} fatal cancer from 50 years of operations.	The annual dose from the consolidated storage facility to the public for the new facility would be 1.7×10^{-6} person-rem. This would result in an estimated 4.3×10^{-8} fatal cancer from 50 years of operations.	The annual dose from the consolidated storage facility to the public would be 1.4×10^{-5} person-rem. This would result in an estimated 3.5×10^{-7} fatal cancer from 50 years of operations.	For the New facility the annual dose from the consolidated storage facility to the public would be 4.6×10^{-5} person-rem. This would result in an estimated 1.2×10^{-6} fatal cancer from 50 years of operations.	This alternative does not apply to ORR.	The annual dose from the consolidated storage facility to the public would be 8.0×10^{-4} person-rem. This would result in an estimated 2.0×10^{-5} fatal cancer from 50 years of operations.	This alternative does not apply to RFETS.
	The annual dose from the consolidated storage facility to the public for upgrade of P-Tunnel would be 1.2×10^{-6} person-rem. This would result in an estimated 3.0×10^{-8} fatal cancers from 50 years of operations.		For the upgrade of the existing facility the annual dose from the consolidated storage facility to the public would be 4.6×10^{-5} person-rem. This would result in an estimated 1.2×10^{-6} fatal cancer from 50 years of operations.			
The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	This alternative does not apply to ORR.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	This alternative does not apply to RFETS.

Attachment A. *Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued*

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The average annual dose from the consolidated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the consolidated storage facility to the involved worker for the new facility would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the consolidated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the consolidated storage facility to the involved worker for the new facility would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	This alternative does not apply to ORR.	The average annual dose from the consolidated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	This alternative does not apply to RFETS.
	The average annual dose from the consolidated storage facility to involved worker for the upgraded facility would be 250 mrem. The estimated fatal cancer risk for average involved worker would be $5.0x10^{-3}$ from 50 years of operation.		The average annual dose from the consolidated storage facility to the involved worker for the upgraded facility would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.			

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
Consolidation of Pu would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.	Consolidation of Pu through the new facility would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.	Consolidation of Pu would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.	Consolidation of Pu (new facility) would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.	This alternative does not apply to ORR.	Consolidation of Pu would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.	This alternative does not apply to RFETS.
	Consolidation of Pu through upgrade of P-Tunnel would result in an annual dose to the total involved workforce of 23 person-rem, which would result in an estimated 0.46 fatal cancer from 50 years of operations.		Consolidation of Pu (upgrade facility) would result in an annual dose to the total involved workforce of 29 person-rem, which would result in an estimated 0.58 fatal cancer from 50 years of operations.			

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Hazardous Chemical Impacts						
The HI and cancer risk for chemical impacts to the public/worker would be 3.92×10^{-6} and 1.25×10^{-8}/ 2.74×10^{-4} and 5.59×10^{-6}.	The HI and cancer risk for chemical impacts to the public/worker would be 2.2×10^{-6} and 1.86×10^{-9}/ 4.43×10^{-4} and 2.90×10^{-6}.	The HI and cancer risk for chemical impacts to the public/worker would be 4.39×10^{-5} and 2.67×10^{-8}/ 1.24×10^{-3} and 5.65×10^{-6}.	The HI and cancer risk for chemical impacts (new facility) to the public/worker would be 1.21×10^{-4} and 6.95×10^{-8}/ 6.19×10^{-4} and 2.83×10^{-6}.	This alternative does not apply to ORR.	The HI and cancer risk for chemical impacts to the public/worker would be 2.71×10^{-6} and 3.4×10^{-9}/ 5.73×10^{-4} and 5.02×10^{-6}.	This alternative does not apply to RFETS.
	The HI and cancer risk for chemical impacts (upgrade P-Tunnel) to the public/worker would be 1.7×10^{-6} and 4.09×10^{-9}/ 5.03×10^{-4} and 6.38×10^{-6}.		The HI and cancer risk for chemical impacts (upgrade facility) to the public/worker would be 1.21×10^{-4} and 6.95×10^{-8}/ 6.19×10^{-4} and 2.83×10^{-6}.			

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Facility Accidents						
Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km, the maximum impacts and 50 year facility lifetime risks would be:	Based on the impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km, the maximum impacts and 50 year facility lifetime risks would be:	Based on the impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km, the maximum impacts and 50 year facility lifetime risks would be:	Based on the impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km, the maximum impacts and 50 year facility lifetime risks would be:	This alternative does not apply to ORR.	Based on the impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km, the maximum impacts and 50 year facility lifetime risks would be:	This alternative does not apply to RFETS.
New Facility **Probability of cancer/risk to worker:** 0.032/ 1.6×10^{-7} **MEI:** 2.3×10^{-4}/ 1.2×10^{-9} **Population:** **Cancer fatalities:** 1.2 **Cancer fatalities risk:** 6×10^{-6}	**New Facility** **Probability of cancer/risk to worker:** 0.021/ 1.1×10^{-7} **MEI:** 3.7×10^{-4}/ 1.9×10^{-9} **Population:** **Cancer fatalities:** 0.027 **Cancer fatalities risk:** 1.4×10^{-7}	**New Facility** **Probability of cancer/risk to worker:** 0.031/ 1.6×10^{-7} **MEI:** 2.4×10^{-4}/ 1.2×10^{-9} **Population:** **Cancer fatalities:** 0.37 **Cancer fatalities risk:** 1.9×10^{-6}	**New Facility** **Probability of cancer/risk to worker:** 0.011/ 5.5×10^{-8} **MEI:** 3.9×10^{-3}/ 2.0×10^{-8} **Population:** **Cancer fatalities:** 0.43 **Cancer fatalities risk:** 2.2×10^{-6}		**New Facility** **Probability of cancer/risk to worker:** 0.02/ 1.0×10^{-7} **MEI:** 3.7×10^{-4}/ 1.9×10^{-9} **Population:** **Cancer fatalities:** 1.4 **Cancer fatalities risk:** 7.0×10^{-6}	

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Public and Occupational Health and Safety (continued)						
Facility Accidents (continued)						
	P-Tunnel **Probability of cancer/risk to Worker:** 5.9×10^{-4}/ 3.0×10^{-9} **MEI:** 1.0×10^{-4}/ 5.0×10^{-10} **Population:** **Cancer Fatalities:** 5.4×10^{-4} **Cancer Fatalities risk:** 2.7×10^{-9}		**Upgrade Existing Facility** **Probability of cancer/risk to Worker:** 8.0×10^{-3}/ 4.0×10^{-8} **MEI:** 2.9×10^{-3}/ 1.5×10^{-8} **Population:** **Cancer Fatalities:** 0.33 **Cancer Fatalities Risk:** 1.7×10^{-6}			
Waste Management						
During construction and operation, all categories of waste would be managed at Hanford.	During construction and operation, all categories of waste would be managed at NTS.	During construction and operation, all categories of waste would be managed at INEL.	During construction and operation, all categories of waste would be managed at Pantex.	This alternative does not apply to ORR.	During construction and operation, all categories of waste would be managed at SRS.	This alternative does not apply to RFETS.
The net increase in generation due to consolidation of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 110,000/ 570 m^3	The net increase in generation due to consolidation (new facility) of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 114,000/ 750 m^3	The net increase in generation due to consolidation of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 65,900/ 660 m^3	The net increase in generation due to consolidation (new facility) of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 97,800/ 720 m^3.	This alternative does not apply to ORR.	The net increase/ decrease in generation due to consolidation of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 2 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,222 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 149,730/ -1,550 m^3	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Waste Management (continued)						
	The net increase in generation due to consolidation (P-Tunnel) of Pu for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 135,000/ 810 m^3		The net increase in generation due to consolidation (upgrade facility) of Pu for liquid /solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 109,500/ 780 m^3.			

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Consolidate all Pu Material at One Site Using Upgraded and/or New Facility; HEU Remains at ORR (continued)						
Intersite Transportation						
Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (new facility) storage site would be 0.278.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (new facility) storage site would be 0.175. Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (upgrade P-Tunnel) storage site would be 0.175.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (new facility) storage site would be 0.208.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (new facility) storage site would be 0.082. Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (upgrade facility) storage site would be 0.082.	This alternative does not apply at ORR.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated (new facility) storage site would be 0.356.	The risk associated with transport of RFETS materials would have a range between 0.028 and 0.077.
Environmental Justice						
Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportiunately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	This alternative does not apply at ORR.	Because of the high percent of minority and low-income population surrounding SRS, the potential exists for these populations to be disproportionately affected by an accident causing a radiological release.	Impacts would not disproportionately affect minority or low-income populations.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility						
Land Resources						
New storage facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the Hanford site boundary.	New storage facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the NTS site boundary.	New storage facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the INEL site boundary.	New facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the Pantex site boundary.	New Pu storage facility would disturb 58.5 ha of land area during construction of which 56 ha would be used during operation.	New facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the SRS site boundary.	This alternative does not apply to RFETS.
	Upgrade P-Tunnel would disturb 25 ha of land area during construction of which 20 ha would be used during operation. As a modification of an existing facility, the 1.6-km (1-mi) buffer zone is established.			New Pu storage facility and modify Y–12 would disturb 64 ha of land area during construction of which 58 ha would be used during operation.		

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Land Resources (continued)						
				New Pu and HEU storage facility would disturb 94 ha of land area during construction of which 88 ha would be used during operation. For all subalternatives, the buffer zone is less than 1.6-km (1-mi) but contained within the ORR site boundary.		
The alternative would be consistent with the current VRM Class 5 designation.	All subalternatives would be consistent with the current Class 5 designation.	The alternative would be consistent with the current VRM Class 5 designation.	The alternative would be consistent with the current VRM Class 5 designation.	All subalternatives would change the current VRM Class 4 designation to Class 5.	The alternative would change the current VRM Class 4 designation to Class 5.	This alternative does not apply to RFETS.

Attachment A. ***Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued***

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Site Infrastructure						
There would be minimal impact from construction. Operation impacts would increase in site infrastructure needs by:	Natural gas and peak load would be most impacted by the consolidation option. About 5 to 140 million m^3 of natural gas would be required depending on the option chosen. Operational impacts would require slight increase in site infrastructure needs:	Construction requirements would constitute a small change in site resource requirements. Operational impacts would require slight increase in site infrastructure needs:	Oil would have the highest increase (about 1.8 percent) over No Action but would not exceed available site resources. During operation all the site infrastructure resources required would be less than site availability except peak load which would be 20 MWe an increase of 47 percent. Operational impacts would require slight increase in site infrastructure needs:	The collocation of HEU with special nuclear materials storage plant would consume about 25 percent more resources than the construction of a consolidated special nuclear material facility, and modify the existing HEU storage facility only. Operational impacts would require slight increase in site infrastructure needs:	Construction requirements would constitute a small change in site resource requirements. Operational requirement would be slightly greater with a peak load of 143 MWe. Operational impacts would require slight increase in site infrastructure needs:	This alternative does not apply to RFETS.
EE: 37,096/ 13,096 MWh/yr PEL: 0 MWe Fuel (oil/gas): 38,000/3,964,380 l/yr / (38,000/ 3,398,040) m^3/yr	**New Facility** EE: 13,096 MWh/yr PEL: 0 MWe Fuel (oil/gas): 38,000 l/yr / 3,398,040 m^3/yr	EE: 0 MWh/yr PEL:0 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr.	EE: 0 l/yr PEL: 6.4 MWe Fuel (oil/gas): 0 l/yr / 0 m^3/yr.	**New Pu & HEU Facility** EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 12,210 l/yr / 0 m^3/yr	EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 49,000 l/yr / 0 m^3/yr.	
	Upgrade Existing P-Tunnel EE: 37,096 MWh/yr PEL: 0 MWe Fuel (oil/gas): 38,000 l/yr / 3,964,380 m^3/yr.					

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Site Infrastructure (continued)						
This option does not apply at Hanford.	This option does not apply at NTS.	This option does not apply at INEL.	This option does not apply at Pantex.	**New Pu & upgrade of HEU Facility** EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 12,210 l/yr / 0 m^3/yr. **New Pu Facility** EE: 0 MWh/yr PEL: 0 MWe Fuel (oil/gas): 12,210 l/yr/ 0 m^3/yr	This option does not apply at SRS.	This alternative does not apply to RFETS.
Air Quality and Noise						
During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Water Resources						
During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines for all subalternatives.	During operation, site is expected to comply with ambient air standards and guidelines.	This alternative does not apply to RFETS.
No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	This alternative does not apply to RFETS.
The total percent increase in surface water use and discharge Juring construction would be 0.8 and 5.0.	The total percent increase in groundwater and discharge use during P-Tunnel/New Facility construction would be 1.5/4.5 and 10/16. No surface water would be used for this option.	The total percent increase in groundwater use and discharge during construction would be 1.4 and 0.02. No surface water would be used for this option.	The total percent increase in groundwater use and discharge during construction would be 43 and 9.2. No surface water would be used for this option.	The total percent increase in surface water use and discharge during construction for the new Pu facility, new Pu and upgrade of HEU facility, and new Pu and HEU facility would be 0.6/0.6/0.7 and 0.4/0.4/0.6. No groundwater would be used for this option.	The total percent increase in groundwater use and discharge during construction would be 0.8 and 1.9. No surface water would be used for this option.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Water Resources (continued)						
The total percent increase in surface water use and discharge during operation would be 1.1 and 0.0.	The total percent increase in groundwater use during operation for P-Tunnel and new facility storage would be 9.2/6.7. No surface water would be used. Discharge would be recycled.	The total percent increase in groundwater use during operation would be 1.2. No surface water would be used. Discharge would be recycled.	The total percent increase in groundwater use during operation would be 52.2. No surface water would be used. Discharge would be recycled.	The total percent increase in surface water use and discharge during operation would be 2.0/2.0/2.5 and 6.4/6.4/8.1. No groundwater would be used.	The total percent increase in groundwater use and discharge during operation would be 3.4 and 31.4.	This alternative does not apply to RFETS.
No construction or operation would take place in the 100- year or 500-year floodplains.	No construction or operation would take place in the 100-year or 500-year floodplains.	No construction or operation would take place in the 100- or 500-year floodplains.	No construction or operation would take place in the 100-year or 500-year floodplains.	No construction or operation would take place in the 100- year or 500-year floodplains.	No construction or operation will take place in would 100-year floodplain.	This alternative does not apply to RFETS.
Geology and Soils						
Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	Construction and operation would not affect the geological conditions.	This alternative does not apply to RFETS.
Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	Soil erosion due to wind and stormwater would be minor.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Biological Resources						
Construction and operation would disturb 94 ha (0.06 percent of Hanford) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 94 ha (less than 0.03 percent of NTS) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 94 ha (0.04 percent of INEL) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 94 ha (3 percent of Pantex) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation of consolidated and collocated facilities would disturb 94 ha (less than 0.7 percent of ORR) of terrestrial habitat. Construction would have some adverse effects on animal populations.	Construction and operation would disturb 94 ha (0.1 percent of SRS) of terrestrial habitat. Construction would have some adverse effects on animal populations.	This alternative does not apply to RFETS.
	P-Tunnel upgrade would have minimal construction impact because it would take place on disturbed areas.			New consolidation of Pu would disturb 58.5 ha. New consolidation of Pu and upgrade would disturb 64 ha.		
Impacts from cooling towers would not be expected since salt drift would be minimal	Dry cooling towers would preclude impacts from salt drifts.	Dry cooling towers would preclude impacts from salt drifts.	Dry cooling towers would preclude impacts from salt drifts.	Impact from cooling towers would not be expected since salt drift would be minimal.	Impact from cooling towers would not be expected since salt drift would be minimal.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Biological Resources (continued)						
Construction and operation would have minimal effect on wetlands and aquatic resources.	Construction and operation would not affect wetland and aquatic resources.	Construction and operation would no affect on wetlands and aquatic resources.	Construction-related ground disturbance may increase the potential for sediment runoff to wetlands and aquatic resources. During construction discharge of treated wastewater could cause wetland to lose some plant communities. Operational impacts would be minimal.	Construction-related ground disturbance may increase the potential for sediment runoff to wetlands and aquatic resources. During construction discharge of treated wastewater could cause wetland to lose some plant communities. Operational impacts would be minimal.	During construction and operation, there would be minimal effect on wetlands and aquatic resources.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Biological Resources (continued)						
Federal-listed threatened and endangered species would not be affected. A number of Federal and State candidate species could lose breeding and foraging habitat.	The desert tortoise is the only Federal-listed species that could be affected during construction and operation. Several Federal candidate species could lose breeding and foraging habitat. P-Tunnel would not impact the desert tortoise.	Federal-listed threatened and endangered species would not be affected. A number of Federal and State candidate species could lose breeding and foraging habitat.	Bald eagle is the only Federal-listed species that could be affected during construction. Several Federal candidate species may also be affected during construction and operation.	Federal-listed threatened and endangered species would not be affected. The Tennessee dace (deemed in need of management by the State) could be affected by siltation. A number of state listed plants could also be impacted by clearing activities.	Federal-listed threatened and endangered species would not be affected. Several special status species could be affected by construction due to a loss of habitat.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Cultural and Paleontological Resources						
Some NRHP-eligible prehistoric and historic resources may occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact. 25 ha would be disturbed during P-Tunnel modification. Some NRHP-eligible sites may be affected. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact.	It is unlikely that NRHP-eligible prehistoric and historic resources occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 94 ha that would be disturbed during construction. Operation would not result in additional impact.	This alternative does not apply to RFETS.
Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.	It is unlikely that Native American resources would be affected by construction and operation.	It is unlikely that Native American resources would be affected by construction and operation.	It is unlikely that Native American resources would be affected by construction and operation.	This alternative does not apply to RFETS.
Some paleontological resources may occur within the land to be disturbed during construction.	Some paleontological resources may occur within the land to be disturbed during construction.	Paleontological resources may be affected from deep project related excavations.	It is unlikely that paleontological resources occur within the acreage to be disturbed during construction.	ORR does not contain scientifically valuable paleontological remains.	SRS does not contain scientifically valuable paleontological remains.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Socioeconomics						
During peak construction/ operation the percent growth in employment would be less than 1 percent over No Action.	During peak construction/ operation the percent growth in employment would be less than 1 percent over No Action. P-Tunnel the percent growth would be 0.35 percent/ 0.27 percent.	During peak construction/ operation the percent growth in employment would be 2 percent/ 1 percent over No Action.	During peak construction/ operation the percent growth in employment would be 1 percent over No Action.	During peak construction/ operation for all Pu and Pu with HEU the percent growth in employment would be less than 1 percent over No Action.	During peak construction/ operation the percent growth in employment would be 1 percent/less than 1 percent over No Action.	This alternative does not apply to RFETS.
Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	Local transportation would change from free flow to a somewhat restricted condition.	Local transportation would not change appreciably.	Local transportation would not change appreciably.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Public and Occupational Health and Safety						
Normal Radiological Impacts						
The annual dose from the collocated storage facility to the MEI of the public would be 2.6×10^{-6} mrem and the estimated risk of fatal cancer for the MEI would be 6.5×10^{-11} from 50 years of operations.	For the collocation alternative, the new facility storage would result in an annual dose of 1.3×10^{-6} mrem to the MEI and the estimated fatal cancer risk for the MEI would be 3.2×10^{-11} from 50 years of operations. The annual dose from the collocated storage facility to the MEI of the public for P-Tunnel storage would be 5.6×10^{-6} mrem and the estimated risk of fatal cancer for the MEI would be 1.4×10^{-10} from 50 years of operations.	The annual dose from the collocated storage facility to the MEI of the public would be 1.7×10^{-6} mrem and the estimated risk of fatal cancer for the MEI would be 4.3×10^{-11} from 50 years of operations.	The annual dose from the collocated storage facility to the MEI of the public would be 9.7×10^{-6} mrem and the estimated risk of fatal cancer for the MEI would be 2.4×10^{-10} from 50 years of operations.	For all collocated storage facility options, the annual dose to the MEI of the public would be 4.6×10^{-5} mrem and the estimated risk of fatal cancer for the MEI would be 1.2×10^{-9} from 50 years of operations.	The annual dose from the collocated storage facility to the MEI of the public would be 1.4×10^{-5} mrem and the estimated risk of fatal cancer for the MEI would be 3.5×10^{-10} from 50 years of operations.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The annual dose from the collocated storage facility to the public would be 8.7×10^{-5} person-rem. This would cause an estimated 2.2×10^{-6} fatal cancers from 50 years of operations.	The annual dose from the collocated storage facility to the public would be 1.7×10^{-6} person-rem for new facility storage. This would cause an estimated 4.3×10^{-8} fatal cancers from 50 years of operations. For P-Tunnel facility storage the corresponding dose and estimated fatal cancers would be 1.2×10^{-6} and 3.0×10^{-8}.	The annual dose from the collocated storage facility to the public would be 1.4×10^{-5} person-rem. This would cause an estimated 3.5×10^{-7} fatal cancers from 50 years of operations.	The annual dose from the collocated storage facility to the public would be 4.6×10^{-5} person-rem. This would cause an estimated 1.2×10^{-6} fatal cancers from 50 years of operations.	For all collocated storage facility options, the annual dose to the public would be 8.2×10^{-4} person-rem. This would cause an estimated 2.1×10^{-5} fatal cancers from 50 years of operations.	The annual dose from the collocated storage facility to the public would be 7.8×10^{-4} person-rem. This would cause an estimated 2.0×10^{-5} fatal cancers from 50 years of operations.	This alternative does not apply to RFETS.
The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	The doses and resulting fatal cancers to the public from total site operations would remain virtually the same as for the No Action Alternative.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	The average annual dose from the collocated storage facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would be $5.0x10^{-3}$ from 50 years of operation.	This alternative does not apply to RFETS.
Consolidation of Pu and HEU would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.	Consolidation of Pu and HEU would result in an annual dose to the total involved workforce of 45 person-rem which would result in an estimated 0.90 fatal cancers from 50 years of operations.	Consolidation of Pu and HEU would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.	Consolidation of Pu and HEU would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.	Consolidation of Pu and HEU (new Pu and HEU facility) would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.	Consolidation of Pu and HEU would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.	This alternative does not apply to RFETS.

Attachment A. *Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued*

Henford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
	Consolidation of Pu and HEU (P-Tunnel) would result in an annual dose to the total involved workforce of 45 person-rem which would result in an estimated 0.90 fatal cancers from 50 years of operations.			Consolidation of Pu and HEU (new Pu and upgrade HEU facility) would result in an annual dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.		
				Consolidation of Pu and HEU (new facility and no upgrade) would result in an annual incremental dose to the total involved workforce of 24 person-rem which would result in an estimated 0.48 fatal cancers from 50 years of operations.		

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Hazardous Chemical Impacts						
The HI and cancer risk for chemical impacts to the public/worker would be 1.57×10^{-5} and 1.25×10^{-8}/ 7.12×10^{-4} and 5.59×10^{-6}.	The HI and cancer risk for chemical impacts to the public/worker would be 4.26×10^{-6} and 1.86×10^{-9}/ 7.28×10^{-4} and 2.9×10^{-6}.	For new facility the HI and cancer risk for chemical impacts to the public/worker would be 7.64×10^{-5} and 2.67×10^{-8}/ 1.9×10^{-3} and 5.65×10^{-6}. For upgrade P-Tunnel facility the HI and cancer risk for chemical impacts to the public/worker would be: 3.01×10^{-6}/ 4.09×10^{-9} and 0/ 6.04×10^{-4}/ 6.38×10^{-6} and 0.	The HI and cancer risk for chemical impacts to the public/worker would be 2.05×10^{-4} and 6.95×10^{-8}/ 9.27×10^{-4} and 2.83×10^{-6}.	For all subalternatives the HI and cancer risk for chemical impacts to the public/worker would be 1.47×10^{-5} and 7.30×10^{-8}/ 1.34×10^{-3} and 5.93×10^{-6}.	The HI and cancer risk for chemical impacts to the public/worker would be 6.21×10^{-6} and 3.4×10^{-9}/ 1.03×10^{-3} and 5.02×10^{-6}.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Public and Occupational Health and Safety (continued)						
Facility Accidents						
Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 619 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km the maximum impacts and 50 year facility lifetime risks would be:	This alternative does not apply to RFETS.
Probability of cancer/risk to **Worker:** 0.032/ 1.6×10^{-7} **MEI:** 2.3×10^{-4}/ 1.2×10^{-9} **Population:** **Cancer Fatalities:** 1.2 **Cancer Fatalities Risk:** 6.0×10^{-6}	**Probability of cancer/risk to** **Worker:** 0.021/ 1.1×10^{-7} **MEI:** 3.7×10^{-4}/ 1.9×10^{-9} **Population:** **Cancer Fatalities:** 0.027 **Cancer Fatalities Risk:** 1.4×10^{-7}	**Probability of cancer/risk to** **Worker:** 0.031/ 1.6×10^{-7} **MEI:** 2.4×10^{-9}/ 1.2×10^{-9} **Population:** **Cancer Fatalities:** 0.37 **Cancer Fatalities Risk:** 1.9×10^{-6}	**Probability of cancer/risk to** **Worker:** 0.011/ 5.5×10^{-8} **MEI:** 1.7×10^{-4}/ 8.5×10^{-10} **Population:** **Cancer Fatalities:** 0.43 **Cancer Fatalities Risk:** 2.2×10^{-6}	**Probability of cancer/risk to** **Worker:** 0.046/ 2.3×10^{-7} **MEI:** 0.058/2.9×10^{-7} **Population:** **Cancer Fatalities:** 6.0 **Cancer Fatalities Risk:** 3.0×10^{-5}	**Probability of cancer/risk to** **Worker:** 0.02/ 1.0×10^{-7} **MEI:** 2.6×10^{-4}/ 1.3×10^{-9} **Population:** **Cancer Fatalities:** 1.5 **Cancer Fatalities Risk:** 7.5×10^{-6}	

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Waste Management						
During construction and operation, all categories of waste would be managed at Hanford.	During construction and operation, all categories of waste would be managed at NTS.	During construction and operation, all categories of waste would be managed at INEL.	During construction and operation, all categories of waste would be managed at Pantex, except NLW which would be shipped to NTS unless new NLW facilities were built.	During construction and operation, all categories of waste would be managed at ORR.	During construction and operation, all categories of waste would be managed at SRS.	This alternative does not apply to RFETS.
The net increase in generation due to collocation for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 146,000/ 880 m^3	The increase due to collocation of HEU and New Facility for liquid /solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 Haz: 2/2 m^3 Nonhaz: 153,000/ 950 m^3	The net increase in generation due to collocation for liquid /solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 86,800/ 860 m^3	The net increase in generation due to collocation for liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 129,500/ 920 m^3	The net increase in generation due to collocation (new facility) liquid/solid would be as follows: TRU: less than 0.1/ 10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 171,830/ 870 m^3	The net increase in generation due to upgrade for liquid/ solid would be as follows: TRU: less than 0.1/ 2 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,262 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 195,790/ -1,350 m^3	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Waste Management (continued)						
This option does not apply at Hanford.	The net increase in generation due to collocation (P-Tunnel) for liquid/solid would be as follows: TRU: less than 0.1/10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,300 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 189,000/980 m^3	This option does not apply at INEL.	This option does not apply at Pantex.	The net increase in generation due to collocation (upgrade HEU and new Pu) of waste liquid/solid would be as follows: TRU: less than 0.1/10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,263 m^3 Mixed LLW: less than 1/66 m^3 HAZ: 2/2 m^3 Nonhaz: 136,630/701 m^3	This option does not apply at SRS.	This alternative does not apply to RFETS.
This option does not apply to Hanford.	This option does not apply to NTS.	This option does not apply to INEL.	This option does not apply to Pantex.	The net increase in generation due to collocation (existing HEU and new Pu) for liquid /solid would be as follows: TRU: less than 0.1/10 m^3 Mixed TRU: 0/4 m^3 LLW: 17/1,260 m^3 Mixed LLW: less than 1/65 m^3 HAZ: 2/2 m^3 Nonhaz: 136,630/670 m^3	This option does not apply to SRS.	This alternative does not apply to RFETS.

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Intersite Transportation of Fissile Materials						
Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 1.08.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.832.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.877.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.461.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.293.	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.505.	The risk associated with transport of RFETS materials would have a range between 0.028 and 0.077.
	Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new facility) storage site would be 0.832.			Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new Pu and upgrade HEU facility) storage site would be 0.293.		
				Maximum potential fatalities from intersite transportation of Pu and HEU to a consolidated and collocate (new Pu and existing HEU facility) storage site would be 0.293.		

Attachment A. Summary Comparison of Environmental Impacts for the No Action and Long-Term Storage Alternatives—Continued

Hanford Site	Nevada Test Site	Idaho National Engineering Laboratory	Pantex Plant	Oak Ridge Reservation	Savannah River Site	Rocky Flats Environmental Technology Site
Collocation of Pu with HEU Storage Facilities Upgrade and/or New Facility (continued)						
Environmental Justice						
Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Because of the high percent of minority and low-income population surrounding SRS, the potential exists for these populations to be disproportionately affected by an accident causing a radiological release.	This alternative does not apply to RFETS.

Attachment B:

Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives

---

Attachment B:

Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives

Land Resources S–124

Site Infrastructure S–126

Air Quality and Noise S–128

Water Resources S–130

Geology and Soils S–134

Biological Resources S–136

Cultural and Paleontological Resources S–138

Socioeconomics S–140

Public and Occupational Health and Safety

- Normal Radiological Impacts S–142
- Hazardous Chemical Impacts S–146
- Facility Accidents S–148

Waste Management S–152

Intersite Transportation of Fissile Materials S–154

Environmental Justice S–154

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Land Resources			
The facility would disturb 24 ha of land area for construction of which 12 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary, except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.	The facility would disturb 36 ha of land area for construction of which 28 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary, except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.	The facility would disturb 62 ha of land area for construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary.	The facility would disturb 46 ha of land area for construction of which 18 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary, except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.	The facility would disturb 62 ha of land area for construction of which 56 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary.	The facility would disturb 85 ha of land area for construction of which 36 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary, except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.	The facility would disturb 32 ha of land area for construction of which 12 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the site boundary, except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.
The alternative would be consistent with the current Class 5 VRM designation.	The alternative would be consistent with the current Class 5 VRM designation.	The VRM classification would be determined after the site is selected.	The alternative would be consistent with the current Class 5 VRM designation. At ORR, classification would change from Class 4 to 5.	The VRM classification would be determined after the site is selected.	The alternative would be consistent with the current Class 5 VRM designation. At ORR, classification would change from Class 4 to 5.	The alternative would be consistent with the current Class 5 VRM designation. At ORR, classification would change from Class 4 to 5.

Attachment B.   Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors			
		Existing Light Water Reactors Alternative (per single unit)	Partially Completed LWR Alternative (per single unit)	Evolutionary LWR Alternative (per single unit)	CANDU Reactor Alternative
Land Resources					
No disturbance or additional land area would be required since existing facility would be used. As an existing facility, a buffer zone is established.	The facility would disturb 121 ha of land area for construction of which 89 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the boundary of all sites except for ORR, where the buffer zone is less than 1.6-km (1-mi) but contained within the site boundary.	No disturbance or additional land area would be required due to the existing conditions. As an existing facility, a buffer zone is established.	No disturbance or additional land area would be required since the reactor is partially completed. The buffer zone would be established.	The facility would disturb 284 ha of land area for construction of which 142 ha would be used during operation. The facility would be located in a 1.6-km (1-mi) buffer zone contained within the boundary of all sites except for ORR, where the buffer zone is less than 1.6-km (1-mi), but contained within the site boundary.	Does not apply.
The alternative would be consistent with the current Class 5 VRM designation.	The alternative would be consistent with the current Class 5 VRM designation, except at SRS where the existing Class 4 designation would change to Class 5. VRM Classification of the Generic range would likely range from Class 4 to Class 5.	The VRM classification of the developed area would likely be Class 5.	The VRM classification would likely be Class 5.	The existing Class 4 VRM designation would change to Class 5 at Pantex and SRS; the existing Class 3 VRM designation would change to Class 5 at ORR; and the existing Class 5 VRM designation at Hanford, NTS, and INEL would remain.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Site Infrastructure			
Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:	Site infrastructure requirements and increase over site availability are as follows:
Construction Requirement (annual): EE: 2,000 MWh PEL: 5 MWe Fuel (oil/gas): 94,600 l / 0 m^3	Construction Requirement (annual): EE: 1,000 MWh PEL: 0.5 MWe Fuel (oil/gas): 189,420 l / 0 m^3	Construction Requirement (life of option): EE: 1,800 MWh Fuel (oil/gas): 6,400,000 l / m^3	Construction Requirement (annual): EE: 10,200 MWh PEL: 2.1 MWe Fuel (oil/gas): 3,000,000 l / 0 m^3	Construction Requirement (life of option): EE: 1,700 MWh Fuel (oil/gas): 6,000,000 l / 0 m^3	Construction Requirement (annual): EE: 2,100 MWh PEL: 5 MWe Fuel (oil/gas): 100,000 l / 0 m^3	Construction Requirement (annual): EE: 8,000 MWh PEL: 1.5 MWe Fuel (oil/gas): 2,200,000 l / 0 m^3
range of increase EE: 0 MWh PEL: 0 to 1.4 MWe Fuel (oil/gas): 0 to 94,600 l/ 0 m^3	range of increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 to 189,420 l/ 0 m^3	possible increase EE: 0 MWh Fuel (oil/gas): 0 l/ 0 m^3	possible increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 to 3,000,000 l/ 0 m^3	possible increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 l/ 0 m^3	range of increase EE: 0 MWh PEL: 0 to 1.4 MWe Fuel (oil/gas): 0 to 100,000 l/ 0 m^3	range of increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 to 2,200,000 l/ 0 m^3
Operation Requirement: EE: 13,000 MWh PEL: 5 MWe Fuel (oil/gas): 20,000 l / 2,265,000 m^3	Operation Requirement: EE: 21,000 MWh PEL: 5 MWe Fuel (oil/gas): 39,750 l / 4,361,000 m^3	Operation Requirement: EE: 6,500 MWh PEL: 2 MWe Fuel (oil/gas): 774,100 l/ 5,100,000 m^3	Operation Requirement: EE: 35,000 MWh PEL: 5 MWe Fuel (oil/gas): 208,200 l / 3,780,000 m^3	Operation Requirement: EE: 6,100 MWh PEL: 2 MWe Fuel (oil/gas): 773,400 l / 4,813,900 m^3	Operation Requirement: EE: 12,000 MWh PEL: 3 MWe Fuel (oil/gas): 378,500 l / 0 m^3	Operation Requirement: EE: 25,000 MWh PEL: 3 MWe Fuel (oil/gas): 189,270 l / 3,511,308 m^3
range of increase EE: 0 MWh PEL: 0 to 1.4 MWe Fuel (oil/gas): 0 to 20,000 l/0 to 2,265,000 m^3	range of increase EE: 0 MWh PEL: 0 to 1.4 MWe Fuel (oil/gas): 0 to 39,750 l/0 to 4,361,000 m^3	Possible increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0l/ 0 to 100,000 m^3	range of increase EE: 0 MWh PEL: 0 to 1.4 MWe Fuel (oil/gas): 0 to 208,200 l/0 to 3,780,000 m^3	possible increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 l/ 0 m^3	range of increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 to 378,500 l/0 m^3	range of increase EE: 0 MWh PEL: 0 MWe Fuel (oil/gas): 0 to 189,270 l/0 to 3,511,308 m^3

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Site Infrastructure			
Infrastructure requirement and increase over site availability are as follows: **Construction:** would be minimal.	Infrastructure requirement and increase over No Action are as follows: **Construction:** EE: 833 MWh (0 MWh) PEL: 1 MWe (0 We) Fuel (oil/gas): 126,180 l / 0 m^3 (0 to 126,180 l/ 0 m^3)	Impact to infrastructure would be minimal since facility exists.	There would be no impacts to site infrastructure during construction or operation. **Construction:** would be minimal.	Infrastructure requirement and increase over site availability as follows: **Construction:** EE: 120,000 MWh (0 MWh) PEL: 20 MWe (0 to 16.4 MWe) Fuel (oil/gas): 946,000 l/ 0 m^3 (0 to 946,000 l/ 0 m^3)	Does not apply.
Operation: EE: 2,400 MWh (0 MWh) PEL: 0.008 MWe (0 MWe) Fuel (oil/gas): 0 l / 0 m^3 (0 l / 0m^3)	**Operation:** EE: 13,000 MWh (0 MWh) PEL: 5 MWe (0 to 4.5 MWe) Fuel (oil/gas): 20,000 l / 2,350,000 m^3 (0 to 20,000 l / 0 to 2,350,000 m^3)		**Operation:** EE: 700,000/ 1,100,000 MWh PEL 96 to140 MWe Fuel (oil/gas): 757,000 l / 0 m^3	**Operation (large reactor):** EE: 1,100,000 MWh (0 to 1,068,096 MWh) PEL: 140 MWe (0 to 136.7 MWe) Fuel (oil/gas): 757,000 l / 0 m^3 (0 to 757,000 l/0 m^3) **Operation (small reactor):** EE: 580,000 MWh (0 to 528,096 MWh) PEL: 75 MWe (0 to 71.4 MWe) Fuel (oil/gas): 416,000 l / 0 m^3 (0 to 416,000 l/0 m^3)	

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Air Quality and Noise			
During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.
During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.
No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.

Attachment B. *Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued*

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors			
		Existing Light Water Reactors Alternative (per single unit)	Partially Completed LWR Alternative (per single unit)	Evolutionary LWR Alternative (per single unit)	CANDU Reactor Alternative
		Air Quality and Noise			
During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air standards and guidelines.	During construction, site is expected to comply with ambient air atandards and guidelines.	Does not apply.
During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	During operation, site is expected to comply with ambient air standards and guidelines.	Does not apply.
No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	No appreciable change in offsite noise levels would occur.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Water Resources			
Facility water requirement and discharge during construction would be as follows: 1.3 million l/yr and 1.3 million l/yr	Facility water requirement and discharge during construction would be as follows: 2.4 million l/yr and 2.4 million l/yr	Water requirement and wastewater generation from construction for a generic site would be as follows: SW or GW: 15.1 million l/yr WW: 12.0 million l/yr	Facility water requirement and discharge during construction would be as follows: 38 million l/yr and 30.3 million l/yr	Water requirement and wastewater generation from construction for a generic site would be as follows: SW or GW: 15.1 million l/yr WW:12.0 million l/yr	Facility water requirement and discharge during construction would be as follows: 10.6 million l/yr and 4.9 million l/yr	Facility water requirement and discharge during construction would be as follows: 38 million l/yr and 29.5 million l/yr
Water requirement and wastewater generation from construction over No Action would be as follows: SW: 0.01 percent GW: 0.01 to 0.5 percent WW: 0.06 to 1.6 percent	Water requirement and wastewater generation from construction over No Action would be as follows: SW: 0.02 percent GW: 0.02 to 1.0 percent WW: 0.1 to 2.9 percent		Water requirement and wastewater generation from construction over No Action would be as follows: SW: 0.3 percent GW: 0.3 to 15.2 percent WW: 1.3 to 37 percent		Water requirement and wastewater generation from construction over No Action would be as follows: SW: 0.07 to 0.08 percent GW: 0.08 to 4.3 percent WW: 0.2 to 6.0 percent	Water requirement and wastewater generation from construction over No Action would be as follows: SW: 0.03 percent GW: 0.3 to 15.3 percent WW: 1.3 to 36 percent

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Water Resources			
Facility water requirements and wastewater generation during construction would be as follows: 15 million l/yr / 0 million l/yr	Facility water requirements and wastewater generation during construction would be as follows: 1.9 million l/yr / 1.9 million l/yr	There would be no impacts to water (surface or groundwater) resources or wastewater.	Facility water requirements generation during construction would be as follows: 220 million l/yr / 58.1 million l./yr.	Facility water requirements and wastewater generation during construction would be as follows: Large: 126 million l/yr / 104 million l/yr Small: 76 million l/yr / 59 million l/yr	Does not apply.
Water requirement and wastewater generation from construction over No Action would be as follows:	Water requirement and wastewater generation from construction over No Action would be as follows:			Water requirement and wastewater generation from construction over No Action would be as follows:	
SW: 0 percent GW: 0.02 percent WW: 0 percent	SW: 0.01 percent GW: 0.01 to 0.8 percent WW: 0.08 to 2.3 percent			Large Reactor: SW: 0.9 percent GW: 1.0 to 50.6 percent WW: 4.5 to 127 percent Small Reactor: SW: 0.5 to 0.6 percent GW: 0.6 to 30.5 percent WW: 2.6 to 72 percent	

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Water Resources (continued)			
Facility water requirement and discharge during operation would be as follows: 56.8 million l/yr and 56.8 million l/yr	Facility water requirement and discharge during operation would be as follows: 805 million l/yr and 15 million l/yr	Water requirement and wastewater generation from operation for a generic site would be as follows: SW or GW: 165.4 million l/yr WW: 17.6 million l/yr	Facility water requirement and discharge during operation would be as follows: 322 million l/yr and 284 million l/yr	Water requirement and wastewater generation from . operation for a generic site would be as follows: SW or GW: 165.4 million l/yr WW: 17.6 million l/yr	Facility water requirement and discharge during operation would be as follows: 250 million l/yr and 98 million l/yr	Facility water requirement and discharge during construction would be as follows: 250 million l/yr and 97 million l/yr
Water requirement and wastewater generation from operation over No Action would be as follows:	Water requirement and wastewater generation from operations above No Action levels would be as follows:		Water requirement and wastewater generation from operation over No Action would be as follows:		Water requirement and wastewater generation from operation over No Action would be as follows:	Water requirement and wastewater generation from operation over No Action would be as follows:
SW: 0.4 percent GW: 0.4 to 22.8 percent WW: 2.5 to 69.2 percent	SW: 0.6 percent GW: 0.6 to 32.3 percent WW: 0.7 to 18.2 percent		SW:2.2 to 2.4 percent GW: 2.4 to 129 percent WW: 12.4 to 346 percent		SW: 1.7 to 1.9 percent GW: 1.9 to 100.4 percent WW: 4.3 to 120 percent	SW: 1.7 to 1.9 percent GW: 1.9 to 100 percent WW: 4.3 to 118.3 percent
Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Water Resources (continued)			
Facility water requirements and wastewater generation during operation would be as follows: 0.606 million l/yr / 0 million l/yr	Facility water requirements and wastewater generation during operation would be as follows: 56.8 million l/yr / 11.6 million l/yr	There would be no impacts to water (surface or groundwater) resources or wastewater.	Facility water requirements and wastewater generation during operation would be as follows: 69,084 million l/yr discharged for the site.	Facility water requirements and wastewater generation during operation (Wet Site) would be as follows: Large: 60,560 million l/yr /23,504 million l/yr Small: 27,252 million l/yr /10,788 million l/yr (Dry Site) Large: 340.6 million l/yr / 340.6 million l/yr Small: 189 million l/yr / 189 million l/yr	Does not apply.
Water requirement and wastewater generation from operation over No Action would be as follows: SW: 0 percent GW: 0.004 percent WW: 0 percent	Water requirement and wastewater generation from operations above No Action levels would be as follows: SW: 0.4 percent GW: 0.4 to 5.1 percent WW: 0.5 to 14.1 percent		Water requirement and wastewater generation from operation over No Action would be as follows: SW: 0.2 percent GW: 0 percent WW: 0.1 percent	Water requirement and wastewater generation from operation over No Action would be as follows: Large Reactor: SW: 47.4 to 448 percent GW: 2.6 to 137 percent WW: 14.9 to 416 percent Small Reactor: SW: 21.3 to 202 percent GW: 2.5 to 75.9 percent WW: 8.3 to 230 percent	
Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Groundwater quality would not be affected.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Water Resources (continued)			
No construction will take place in areas designated as 100-year and 500-year floodplains for all sites. However, a 500-year floodplain assessment would probably be required at SRS.	No construction will take place in areas designated as 100-year and 500-year floodplains. However, a 500-year floodplain assessment would probably be required at SRS.	No construction will take place in areas designated as 100-year and 500-year floodplains.	No construction will take place in areas designated as 100-year and 500-year floodplains. However, a 500-year floodplain assessment would probably be required at NTS and SRS.	No construction will take place in areas designated as 100-year and 500-year floodplains.	No construction will take place in areas designated as 100-year and 500-year floodplains. However, a 500-year floodplain assessment would probably be required at NTS and SRS.	No construction will take place in areas designated as 100-year and 500-year floodplains. However, a 500-year floodplain assessment would probably be required at NTS and SRS.
			Geology and Soils			
There would no impacts to geologic resources.	There would be no impacts to geologic resources.	There may be minimal impacts to geologic resources.	There would no impacts to geologic resources.	There may be impacts to geologic resources.	There would no impacts to geologic resources.	There would no impacts to geologic resources.
Soil erosion due to wind and stormwater would be minimal.	Soil erosion due to wind and stormwater would be minimal	Soil erosion due to wind and stormwater would be minimal.	Soil erosion due to wind and stormwater would be minimal.	Soil erosion due to wind and stormwater would be minimal.	Soil erosion due to wind and stormwater would be minimal.	Soil erosion due to wind and stormwater would be minimal.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors			
		Existing Light Water Reactors Alternative (per single unit)	Partially Completed LWR Alternative (per single unit)	Evolutionary LWR Alternative (per single unit)	CANDU Reactor Alternative
Water Resources (continued)					
	No construction will take place in areas designated as 100-year or 500-year floodplains. However, a 500-year floodplain assessment would probably be required at NTS, SRS, and Commercial (Generic).		Impacts to floodplains from the partially completed LWR were not evaluated in the site-specific EIS because there were no requirements for floodplain analysis at that time. Site-specific floodplain evaluation would be conducted in future documents.	No construction will probably take place in areas designated as 100-year floodplains for both reactors, however a 500-year floodplain assessment would probably be required at NTS and SRS for the small reactor.	
Geology and Soils					
There would be no impacts to geologic and soils resources.	There would be no impacts to geologic resources.	There would be no impacts to geologic or soil resources.	There would be no impacts to geologic or soil resources.	There would be no impacts to geologic resources for both reactors.	Does not apply.
	Soil erosion due to wind and stormwater would be minimal.			Soil erosion due to wind and stormwater would be minimal.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Biological Resources			
Construction would result in the disturbance of 24 ha of terrestrial habitat.	Construction would result in the disturbance of 36 ha of terrestrial habitat.	Construction would result in the disturbance of 62 ha of terrestrial habitat.	Construction would result in the disturbance of 46 ha of terrestrial habitat.	Construction would result in the disturbance of 62 ha of terrestrial habitat.	Construction would result in the disturbance of 85 ha of terrestrial habitat.	Construction would result in the disturbance of 32 ha of terrestrial habitat.
Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex.	Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex.	Construction and operation has the potential to affect wetlands and aquatic resources.	Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex and site streams at ORR.	Construction and operation has the potential to affect wetlands and aquatic resources.	Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex.	Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex.
One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	Construction and operation would have the potential to affect threatened and endangered species.	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	Construction and operation would have the potential to affect threatened and endangered species.	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Biological Resources			
There would be no impact to biological resources.	Construction would disturb 121 ha of terrestrial habitat.	There would be no impacts to terrestrial resources during construction or operation.	There would be minimal disturbance to terrestrial resources during construction and operation.	Construction would disturb 284 ha of terrestrial habitat.	Does not apply.
	Wetlands and aquatic resources would not be affected, except for possible minor impacts to playas at Pantex.	Wetlands and aquatic resources would not be affected.	During operation, wastewater discharges and salt drift from cooling towers could impact wetlands. Construction may impact wetlands and aquatic species from sedimentation of nearby water bodies. Operation would lead to an increase in impingement, and entrainment and thermal impacts to aquatic organisms.	In general, direct impacts to wetlands and aquatic resources from construction and operation would not be expected at dry sites; however, during operation impacts to the Columbia River at Hanford and playas are possible. Impacts to wetlands and aquatic resources are possible at ORR and SRS.	Does not apply.
	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	Threatened and endangered species would not be affected.	Threatened and endangered species are unlikely to be impacted. Preactivity surveys would be required before construction or operation.	One Federal-listed, threatened species, the desert tortoise (NTS), and several special status species may be affected during construction and operation.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
Cultural and Paleontological Resources						
Some NRHP-eligible prehistoric and historic resources may occur within the 24 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 36 ha that would be disturbed during construction. Operation would not result in additional impact.	Impacts cannot be determined.	Some NRHP-eligible prehistoric and historic resources may occur within the 46 ha that would be disturbed during construction. Operation would not result in additional impact.	Impacts cannot be determined.	Some NRHP-eligible prehistoric and historic resources may occur within the 85 ha that would be disturbed during construction. Operation would not result in additional impact.	Some NRHP-eligible prehistoric and historic resources may occur within the 32 ha that would be disturbed during construction. Operation would not result in additional impact.
Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.		Some Native American resources may be affected by construction and operation.		Some Native American resources may be affected by construction and operation.	Some Native American resources may be affected by construction and operation.
Some paleontological resources may occur within the acreage to be disturbed.	Some paleontological resources may occur within the acreage to be disturbed.		Some paleontological resources may occur within the acreage to be disturbed.		Some paleontological resources may occur within the acreage to be disturbed.	Some paleontological resources may occur within the acreage to be disturbed.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors: Existing Light Water Reactors Alternative (per single unit)	Reactors: Partially Completed LWR Alternative (per single unit)	Reactors: Evolutionary LWR Alternative (per single unit)	Reactors: CANDU Reactor Alternative
Cultural and Paleontological Resources					
There would be no impact to prehistoric and historic resources.	Some NRHP-eligible prehistoric and historic resources may occur within the 121 ha that would be disturbed during construction.	There would be no impact to prehistoric and historic resources.	There would be no impact to prehistoric and historic resources.	Some NRHP-eligible prehistoric and historic resources may occur within the 284 ha that would be disturbed during construction.	Does not apply.
There would be no impact to Native American resources.	Some Native American resources may be affected by construction and operation.	There would be no impact to Native American resources.	Some Native American resources may be affected by operation.	Some Native American resources may be affected by construction and operation.	Does not apply.
There would be no impact to paleontological resources.	Some paleontological resources may occur within the acreage to be disturbed.	There would be no impact to paleontological resources.	There would be no impact to paleontological resources.	Some paleontological resources may occur within the acreage to be disturbed.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Socioeconomics			
Employment increase from construction would be less than 1 percent.	Employment increase during construction would be less than 1 percent.	Employment from construction would require 870 workers at peak construction and 342 workers for life of operation.	Employment increase from construction would be less than 1 percent.	Employment from construction would require 810 workers at peak construction and 280 workers for life of operation.	Employment increase from construction would be much less than 1 percent.	Employment increase from construction would be less then 1 percent.
Employment increases from operation would be less than 1 percent.	Employment could increase 1 percent during operation at some sites.	Since this alternative is based on a generic site, indirect impacts to communities during operation may vary.	Employment increases from operation could increase 1 percent.	Since this alternative is based on a generic site, indirect impacts to communities during operation may vary.	Employment increases from operation would increase about 1 percent.	Employment increases from operation could increase about 1 percent.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Socioeconomics			
Construction is not required for this alternative.	Employment at representative sites would increase less than 1 percent during construction.	Operation would create between 40 and 105 total jobs.	Employment at representative site would increase less than 1 percent during construction.	During construction, employment increase would be approximately 2 percent.	
Employment increase would be much less then 1 percent during full operation.	Employment at representative sites would increase less then 1 percent during operation.	Since this alternative is based on a generic site, indirect impacts to communities during operations may vary.	Employment at representative site would increase less than 1 percent during operation.	During operation, employment increases would be 1 percent.	

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
Public and Occupational Health and Safety						
Normal Radiological Impacts						
The annual dose from this facility to the MEI of the public would range from 6.9×10^{-5} to 6.9×10^{-3} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 3.5×10^{-10} to 7.9×10^{-8}.	The annual dose from this facility to the MEI of the public would range from 9.1×10^{-5} to 9.0×10^{-3} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 4.6×10^{-10} to 1.0×10^{-7}.	The annual dose from this facility to the MEI of the public at representative sites would range from 9.8×10^{-10} to 3.4×10^{-8} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 4.9×10^{-15} to 1.7×10^{-13}.	The annual dose from this facility to the MEI of the public at representative sites would range from 4.0×10^{-9} to 1.4×10^{-7} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 2.0×10^{-14} to 7.0×10^{-13}.	The annual dose from this complex to the MEI of the public at representative sites would range from 1.3×10^{-9} to 4.6×10^{-8} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 6.5×10^{-15} to 2.3×10^{-13}.	The annual dose from this facility to the MEI of the public at representative sites would range from 1.5×10^{-6} to 5.4×10^{-5} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 7.5×10^{-12} to 2.7×10^{-10}.	The annual dose from this facility to the MEI of the public at representative sites would range from 1.1×10^{-7} to 3.7×10^{-6} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 5.5×10^{-13} to 1.9×10^{-11}.
The annual dose from this facility to the total public within 80 km would range from 8.7×10^{-5} to 0.046 person-rem and would result in an estimated 4.4×10^{-7} to 5.3×10^{-4} fatal cancers from facility lifetime operations.	The annual dose from this facility to the total public within 80 km would range from 1.1×10^{-4} to 0.060 person-rem and would result in an estimated 5.5×10^{-7} to 6.9×10^{-4} fatal cancers from facility lifetime operations.	The annual dose from this facility to the total public within 80 km would range from 1.2×10^{-9} to 6.7×10^{-7} person-rem and would result in an estimated 6.0×10^{-12} to 3.4×10^{-9} fatal cancers from facility lifetime operations.	The annual dose from this facility to the total public within 80 km would range from 5.0×10^{-9} to 2.5×10^{-6} person-rem and would result in an estimated 2.5×10^{-11} to 1.2×10^{-8} fatal cancers from facility lifetime operations.	The annual dose from this complex to the total public within 80 km would range from 1.6×10^{-9} to 9.4×10^{-7} person-rem and would result in an estimated 8.0×10^{-12} to 4.7×10^{-9} fatal cancers from facility lifetime operations.	The annual dose from this facility to the total public within 80 km would range from 1.4×10^{-6} to 1.4×10^{-3} person-rem and would result in an estimated 7.0×10^{-9} to 7.0×10^{-6} fatal cancers from facility lifetime operations.	The annual dose from this facility to the total public within 80 km would range from 1.3×10^{-7} to 1.5×10^{-4} person-rem and would result in an estimated 6.5×10^{-10} to 7.6×10^{-7} fatal cancers from facility lifetime operations.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors			
		Existing Light Water Reactors Alternative (per single unit)	Partially Completed LWR Alternative (per single unit)	Evolutionary LWR Alternative (per single unit)	CANDU Reactor Alternative
Public and Occupational Health and Safety					
Normal Radiological Impacts					
The annual dose from this facility to the MEI of the public would be 7.6×10^{-4} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would be 3.8×10^{-9}.	The annual dose from this facility to the MEI of the public would range from 6.6×10^{-4} to 0.063 mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from 5.6×10^{-9} to 7.3×10^{-7}.	The annual dose from the reactor to the MEI of the public would range from -4.3×10^{-4} to 2.5×10^{-3} mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would range from -3.7×10^{-9} to 2.1×10^{-8}.	The annual dose from the reactor to the MEI of the public would be 1.1 mrem. The estimated risk of fatal cancer for the MEI from facility lifetime operations would be 9.4×10^{-6}.	The range of annual dose from the reactor to the MEI of the public: Large: 0.034 to 4.7 mrem Small: 0.026 to 3.8 mrem The estimated risks of fatal cancer for the MEI from facility lifetime operations: Large: 2.9×10^{-7} to 4.0×10^{-5} Small: 2.2×10^{-7} to 3.2×10^{-5}.	Does not apply.
The annual dose from this facility to the total public would be 0.016 person-rem, which would result in an estimated 8.0×10^{-5} fatal cancer for the public from facility lifetime operations.	The annual dose from this facility to the total public would range from 8.4×10^{-4} to 0.40 person-rem, which would result in an estimated 7.1×10^{-6} to 4.6×10^{-3} fatal cancer for the public from facility lifetime operations.	The annual dose from the reactor to the total public would range from -0.059 to 0.86 person-rem, which would result in an estimated -5.0×10^{-4} to 7.3×10^{-3} fatal cancer for the public from facility lifetime operations.	The annual dose from the reactor to the total public would be 8.2 person-rem, which would result in an estimated 0.070 fatal cancer for the public from facility lifetime operations.	The range of annual dose from the reactor to the total public would be: Large: 0.030 to 110 person-rem Small: 0.027 to 88 person-rem The range of fatal cancer for the total public from facility lifetime operations: Large: 2.6×10^{-4} to 0.95 Small: 2.3×10^{-4} to 0.75.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
Public and Occupational Health and Safety (continued)						
Normal Radiological Impacts (continued)						
The average annual dose from this facility to the involved worker would be 200 mrem. The estimated fatal cancer risk for the average involved worker would range from 8.0×10^{-4} to 1.8×10^{-3} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 233 mrem. The estimated fatal cancer risk for the average involved worker would range from 9.3×10^{-4} to 2.1×10^{-3} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 13 mrem. The estimated fatal cancer risk for the average involved worker would be 5.2×10^{-5} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 244 mrem. The estimated fatal cancer risk for the average involved worker would be 9.8×10^{-4} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 13 mrem. The estimated fatal cancer risk for the average involved worker would be 5.2×10^{-5} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 200 mrem. The estimated fatal cancer risk for the average involved worker would be 8.0×10^{-4} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 279 mrem. The estimated fatal cancer risk for the average involved worker would be 1.1×10^{-3} from facility lifetime operations.
The annual dose from this facility to the workforce would be 52 person-rem, and the number of fatal cancers from facility lifetime operations would range from 0.21 to 0.48.	The annual dose from this facility to the workforce would be 133 person-rem, and the number of fatal cancers from facility lifetime operations would range from 0.53 to 1.2.	The annual dose from this facility to the workforce would be 2.7 person-rem, and the number of fatal cancers from facility lifetime operations would be 0.011.	The annual dose from this facility to the workforce would be 110 person-rem, and the number of fatal cancers from facility lifetime operations would be 0.44.	The annual dose from this facility to the workforce would be 2.2 person-rem, and the number of fatal cancers from facility lifetime operations would be 8.8×10^{-3}.	The annual dose from this facility to the workforce would be 110 person-rem, and the number of fatal cancers from facility lifetime operations would be 0.44.	The annual dose from this facility to the workforce would be 120 person-rem, and the number of fatal cancers from facility lifetime operations would be 0.46.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Electrometallurgical Treatment Alternative	MOX Fuel Fabrication Facility	Reactors			
		Existing Light Water Reactors Alternative (per single unit)	Partially Completed LWR Alternative (per single unit)	Evolutionary LWR Alternative (per single unit)	CANDU Reactor Alternative
		Public and Occupational Health and Safety			
Normal Radiological Impacts (continued)					
The average annual dose from this facility to the involved worker would be 40 mrem. The estimated fatal cancer risk for the average involved worker would be 1.6×10^{-4} from facility lifetime operations.	The average annual dose from this facility to the involved worker would be 250 mrem. The estimated fatal cancer risk for the average involved worker would range from 1.7×10^{-3} to 2.3×10^{-3} from facility lifetime operations.	The average annual dose from the reactor to the involved worker would range from 1.3 to 2.7 mrem. The estimated fatal cancer risk for the average involved worker would range from 8.5×10^{-6} to 1.8×10^{-5} from facility lifetime operations.	The average annual dose from the reactor to the involved worker would be 360 mrem. The estimated fatal cancer risk for the average involved worker would be 2.4×10^{-3} from facility lifetime operations.	The average annual doses from the reactor to the involved worker would be 810/800 mrem for large/small. The estimated fatal cancer risk for the average involved worker would be $5.5 \times 10^{-3}/5.4 \times 10^{-3}$ for large/small from facility lifetime operations.	Does not apply.
The annual dose from this facility to the involved workforce would be 2.9 person-rem, and the estimated number of fatal cancers from facility lifetime operations would be 0.012.	The annual dose from this facility to the involved workforce would be 31 person-rem, and the estimated number of fatal cancers from facility lifetime operations would be 0.21 to 0.29.	The annual dose from this reactor to the involved workforce would be 1.6 to 4.8 person-rem, and the estimated number of fatal cancers from facility lifetime operations would be 0.011.	The annual dose from this reactor to the involved workforce would be 380 person-rem, and the estimated number of fatal cancers from facility lifetime operations would be 2.6.	The annual dose from this reactor to the involved workforce would be 170 person-rem for the large reactor and 100 person-rem for the small reactor. The estimated number of fatal cancers from facility lifetime operations would be 1.2 for the large reactor and 0.68 for the small reactor.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
Public and Occupational Health and Safety (continued)						
Hazardous Chemical Impacts						
The incremental chemical HI/cancer risk for the MEI of the public would be between 2.52×10^{-6}/0 and 9.90×10^{-5}/0. The site worker HI / cancer risk would be between 1.48×10^{-5}/ 0 and 3.11×10^{-5}/0.	The chemical HI/ cancer risk for the MEI of the public would be between 4.29×10^{-6}/4.73×10^{-9} and 1.69×10^{-4}/ 1.86×10^{-7}.The site worker HI/cancer risk would be between 7.70×10^{-4}/ 7.2×10^{-6} and 1.61×10^{-3}/ 1.51×10^{-5}.	The chemical HI/ cancer risk for the MEI of the public would be 1.17×10^{-3}/ 0. The site worker HI/cancer risk would be 2.85×10^{-1}/ 0.	The chemical HI/ cancer risk for the MEI of the public would be between 2.32×10^{-4}/0 and 9.11×10^{-3}/0. The site worker HI/ cancer risk would be between 7.23×10^{-2}/ 0 and 1.52×10^{-1}/0.	The chemical HI/ cancer risk for the MEI of the public would be 1.16×10^{-3}/0. The site worker HI/ cancer risk would be 2.83×10^{-1}/0.	The chemical HI/ cancer risk for the MEI of the public would be between 9.95×10^{-5}/0 and 3.91×10^{-3}/0. The site worker HI/ cancer risk would be between 1.87×10^{-2}/0 and 3.93×10^{-2}/0.	The chemical HI/ cancer risk for the MEI of the public would be between 3.87×10^{-4}/0 and 1.52×10^{-2}/0. The site worker HI/ cancer risk would be between 1.60×10^{-2}/0 and 1.70×10^{-1}/0.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Public and Occupational Health and Safety (continued)			
Hazardous Chemical Impacts					
The incremental chemical HI for the maximally exposed member of the public would be $1.75x10^{-6}$. The site worker HI would be $1.55x10^{-5}$.	The incremental chemical HI for the maximally exposed member of the public would be between $4.20x10^{-6}$ and $1.65x10^{-4}$. The site worker HI would be between $2.48x10^{-5}$ and $5.19x10^{-5}$.	The chemical HI for the maximally exposed member of the public and the site worker HI would both be minimal.	The chemical HI for the maximally exposed member of the public and site worker would be same as the original EIS analysis.	The incremental chemical HI would be as follows: Maximally exposed member of the public would be $2.83x10^{-8}$ to $1.11x10^{-6}$ for the large reactor and $2.83x10^{-8}$ to $1.11x10^{-6}$ for the small reactor. Site worker range would be $7.81x10^{-6}$ to $1.64x10^{-5}$ for the large reactor and $7.81x10^{-6}$ to $1.64x10^{-5}$ for the small reactor.	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Deep Borehole			Immobilization	
		Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
		Public and Occupational Health and Safety - (continued)				
Facility Accidents						
Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 23 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 23 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from the reference site, the range of impacts to population and corresponding 10 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 10 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from the reference site, the range of impacts to population and corresponding 10 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 10 year facility life time risks to population, worker, and MEI would be:	Based on the estimated impacts from a set of accidents that propagate radioactive releases to a worker at 1,000 m from the release point (or at the site boundary if less than 1,000 m) to the MEI located at the site boundary and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 10 year facility life time risks to population, worker, and MEI would be:

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Public and Occupational Health and Safety (continued)			
Facility Accidents					
Comparable data are not available.	The estimated impacts from a set of accidents that propagate radioactive release to a worker at 1,000 m from the release point or at the site boundary if less than 1,000 m, to the MEI located at the site boundary, and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 23 year facility life time risks to population, worker, and MEI would be:	Comparable data are not available.	Comparable data are not available.	The estimated impacts from a set of accidents that propagate radioactive release to a worker at 1,000 m from the release point, to the MEI located at the site boundary, and to the general population residing within 80 km from each site, the maximum and minimum impacts to population and corresponding 17 year facility life time risks to population, worker, and MEI would be:	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			**Immobilization**	
Pit Disassembly/ Conversion Facility	**Plutonium Conversion Facility**	**Direct Disposition Alternative**	**Immobilized Disposition Alternative**		**Vitrification Alternative**	**Ceramic Immobilization Alternative**
			Ceramic Immobilization Facility	**Borehole Complex**		
			Public and Occupational Health and Safety - (continued)			
Facility Accidents (continued)						
Probability of Cancer Fatality/Risk **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 2.4×10^{-3}/ 5.5×10^{-9} to 4.2×10^{-3}/9.7×10^{-9} (772m) **MEI:** 5.7×10^{-5}/ 1.3×10^{-10} to 5.2×10^{-3}/1.2×10^{-8} **Population:** Number of cancer fatalities/risk: 0.84/ 1.9×10^{-6} to 4.2×10^{-3}/ 9.7×10^{-9}	**Probability of Cancer Fatality/Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 6.3×10^{-3}/ 1.4×10^{-8} to 0.011/2.5×10^{-8} **MEI:** 1.2×10^{-4}/ 2.8×10^{-10} to 0.014/ 3.2×10^{-8} **Population:** Number of cancer fatalities/risk: 9.2×10^{-3}/2.1×10^{-8} to 1.9/4.4×10^{-6}	**Probability of Cancer Fatality/ Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 6.9×10^{-8}/ 1.4×10^{-9} to 1.6×10^{-7}/3.2×10^{-9} **MEI:** 1.1×10^{-9}/ 2.3×10^{-11} to 3.2×10^{-8}/6.6×10^{-10} **Population:** Number of cancer fatalities/risk: 2.6×10^{-8}/5.4×10^{-10} to 6.1×10^{-6}/1.2×10^{-7}	**Probability of Cancer Fatality/ Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 1.0×10^{-6}/ 1.0×10^{-10} to 1.3×10^{-6}/1.3×10^{-10} **MEI:** 2.3×10^{-8}/ 2.3×10^{-12} to 2.9×10^{-7}/2.9×10^{-11} **Population:** Number of cancer fatalities/risk: 2.3×10^{-7}/2.3×10^{-11} to 5.4×10^{-5}/5.4×10^{-9}	**Probability of Cancer Fatality/ Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 1.3×10^{-10}/1.4×10^{-10} to 3.0×10^{-10}/ 3.2×10^{-10} **MEI:** 2.1×10^{-12}/ 2.3×10^{-12} to 6.1×10^{-11}/6.6×10^{-11} **Population:** Number of cancer fatalities/risk: 8.6×10^{-11}/ 9.3×10^{-11} to 1.6×10^{-8}/1.7×10^{-8}	**Probability of Cancer Fatality/ Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 2.6×10^{-5}/2.6×10^{-10} to 3.8×10^{-5}/3.8×10^{-10} **MEI:** 4.9×10^{-7}/ 4.9×10^{-12} to 7.7×10^{-6}/7.7×10^{-11} **Population:** Number of cancer fatalities/risk: 7.8×10^{-5}/7.8×10^{-10} to 8.4×10^{-3}/ 8.4×10^{-8}	**Probability of Cancer Fatality/ Risk** **Worker at 1,000 m** or at the site boundary if less than 1,000 m: 3.0×10^{-4}/ 3.0×10^{-9} to 3.8×10^{-4}/3.8×10^{-9} **MEI:** 6.8×10^{-6}/ 6.8×10^{-11} to 8.6×10^{-5}/8.6×10^{-10} **Population:** Number of cancer fatalities/risk: 6.9×10^{-5}/6.9×10^{-10} to 0.016/1.6×10^{-7}

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
Public and Occupational Health and Safety (continued)					
Facility Accidents (continued)					
Comparable data are not available.	**Probability of Cancer Fatality/Risk** Worker at 1,000 m or at site boundary if less than 1,000 m: $6.2x10^{-3}$/ $1.4x10^{-8}$ to 0.011/ $2.5x10^{-8}$ MEI: $1.3x10^{-4}$/$3.0x10^{-10}$ to 0.013/$3.0x10^{-8}$ **Population** Number of cancer fatalities/risk: $9.2x10^{-3}$/ $2.1x10^{-8}$ to 2.0/$4.6x10^{-6}$	Comparable data are not available.	Comparable data are not available.	**Probability of Cancer Fatality/Risk** Worker at 1,000 m or at site boundary if less than 1,000 m: 0.09/ $3.2x10^{-8}$ to 0.046/ $1.6x10^{-8}$ MEI: 0.021/$7.5x10^{-9}$ to 0.057/$2.0x10^{-8}$ **Population** Number of cancer fatalities/risk: 0.047/ $1.7x10^{-8}$ to 23.0/$8.2x10^{-6}$	Does not apply.

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	**Plutonium Conversion Facility**	**Direct Disposition Alternative**	**Immobilized Disposition Alternative**		**Vitrification Alternative**	**Ceramic Immobilization Alternative**
			Ceramic Immobilization Facility	**Borehole Complex**		
			Waste Management			
The increase in the generation of liquid / solid waste over No Action is as follows:	The Increase in the generation of liquid / solid waste over No Action are as follows:	The increase in the generation of liquid / solid waste for a generic site over No Action is as follows:	The increase in the generation of liquid / solid waste over No Action is as follows:	The increase in the generation of liquid / solid waste for a generic site over No Action is as follows:	The increase in the generation of liquid / solid waste over No Action is as follows:	The increase in the generation of liquid / solid waste over No Action is as follows:
TRU: 0 m^3 / 45 m^3	TRU: 4 m^3 / 223 m^3	TRU: <1 m^3 / <1 m^3	TRU: 114 m^3 / 153 m^3	TRU: <1 m^3 / <1 m^3	TRU: <1 m^3 / 99 m^3	TRU: 76 m^3 / 99 m^3
Mixed TRU: 0 m^3 / 3 m^3	Mixed TRU: 0 m^3 / 191 m^3	Mixed TRU: 0 m^3 / <0.1 m^3	Mixed TRU: 0 m^3 / 2 m^3	Mixed TRU: 0 m^3 / < 1 m^3	Mixed TRU: 0 m^3 / <1 m^3	Mixed TRU: 0 m^3 / < 1 m^3
LLW: 0 m^3 / 68 m^3	LLW: 45 m^3 / 1,750 m^3	LLW: 2 m^3 / 5m^3	LLW: 10 m^3 / 23 m^3	LLW: 3 m^3 / 6 m^3	LLW: 7 m^3 /14 m^3	LLW:7 m^3 /14 m^3
Mixed LLW: <1 m^3 / 1 m^3	Mixed LLW: <0.1 m^3 / 191 m^3	Mixed LLW: 0 m^3 / 0 m^3	Mixed LLW: 0 m^3 / <1 m^3	Mixed LLW: 0 m^3 / 0 m^3	Mixed LLW: 0 m^3 / <1 m^3	Mixed LLW: 0 m^3 / <1 m^3
HAZ: 4 m^3 / <1 m^3	HAZ: 2 m^3 /11 m^3	HAZ: 110 m^3 / 16 m^3	HAZ: 45 m^3 /23 m^3	HAZ: 132 m^3 / 15 m^3	HAZ: 19 m^3 / 19 m^3	HAZ: 38 m^3 / 19 m^3
Nonhaz (sanitary): 56,800 m^3 / 67 m^3	Nonhaz (sanitary): 15,000 m^3 /2,060 m^3	Nonhaz (sanitary): 10,600 m^3 / 306 m^3	Nonhaz (sanitary): 43,500 m^3 / 917 m	Nonhaz (sanitary): 9,460 m^3 / 291 m^3	Nonhaz (sanitary): 34,100 m^3 / 917 m^3	Nonhaz (sanitary): 34,100 m^3 / 917 m^3

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Waste Management			
Spent nuclear fuel would not be generated.	Spent nuclear fuel would not be generated.	Spent nuclear fuel generation would increase approximately 14 t (PWR) and 23 t (BWR).	Spent nuclear fuel generation would increase approximately 22 t to 47 t per reactor.	Spent nuclear fuel generation would increase approximately 26 t/reactor for large (2 reactor) and 12 t/reactor for small (4 reactors).	Does not apply.
The net increase in the generation of liquid/solid waste as a result of Electrometallurgical Treatment of surplus materials is as follows:	The net increase in the generation of liquid/ solid waste over No Action is as follows:	There would be no increase in the amount of waste generated.	The range of increase in the generation of liquid/ solid waste for a representative site over No Action is as follows:	The range of increase in the generation of liquid/ solid waste over No Action is as follows:	
TRU: 0 m^3 / 6 m^3	TRU: 0 m^3 / 306 m^3		TRU: Not generated.		
Mixed TRU: 0 m^3 / <1 m^3	Mixed TRU: 0 m^3 / 4 m^3		Mixed TRU: Not generated.		
LLW: 0 m^3 / 55 m^3	LLW: 4 m^3 / 153 m^3		LLW: 18,930 m^3 / 57 - 637 m^3	LLW: Large: 18,900 m^3 / 497 m^3 Small: 2,990 m^3 / 268 m^3	
Mixed LLW: 0 m^3 / <1 m^3	Mixed LLW: <1 m^3 / 38 m^3		Mixed LLW: 0 m^3 / 102 m^3	Mixed LLW: Large: 0 m^3 / 5 m^3 Small: 0 m^3 / 5 m^3	
HAZ: 0 m^3 / 1 m^3	HAZ: 4 m^3 / 153 m^3		HAZ: included in solid / 27 m^3	HAZ: Large: included in solid / 27 m^3 Small: included in solid / 27 m^3	
Nonhaz (sanitary): 2,730 m^3 / 1,530 m^3	Nonhaz (sanitary): 11,400 m^3 / 76 m^3		Nonhaz (sanitary): 341,000 m^3 / 5,280 m^3	Nonhaz (sanitary): Large: 23,900,000 (wet site) 342,000 m^3 (dry site)/ 5,280 m^3 Small: 190,000 (dry site) 11,000,000 (wet site)/ 3,210 m^3.	

Attachment B. Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued

		Deep Borehole			Immobilization	
Pit Disassembly/ Conversion Facility	Plutonium Conversion Facility	Direct Disposition Alternative	Immobilized Disposition Alternative		Vitrification Alternative	Ceramic Immobilization Alternative
			Ceramic Immobilization Facility	Borehole Complex		
			Intersite Transportation			
Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to pit disassembly/ conversion would be 0.205.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to plutonium conversion would be 0.641.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to direct disposition alternative through Pu conversion facility would be 1.19.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to ceramic immobilization facility through Pu conversion facility is included in borehole complex.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to borehole complex through Pu conversion and ceramic immobilization facility would be 2.13.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to HLW repository through Pu conversion and vitrification would be 1.41.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to HLW repository ceramic immobilization alternative would be 1.44.
			Environmental Justice			
Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts could disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts could disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts could disproportionately affect minority or low-income populations.

Attachment B. *Summary Comparison of Environmental Impacts for Plutonium Disposition Alternatives—Continued*

		Reactors			
Electrometallurgical Treatment Alternative	**MOX Fuel Fabrication Facility**	**Existing Light Water Reactors Alternative (per single unit)**	**Partially Completed LWR Alternative (per single unit)**	**Evolutionary LWR Alternative (per single unit)**	**CANDU Reactor Alternative**
		Intersite Transportation			
Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to electrometallurgical treatment through Pit disassembly/conversion and Pu conversion facility would be 0.933.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to MOX fuel fabrication site would be 0.552.	The incremental potential fatalities from the intersite transportation of Pu from existing storage sites to existing light water reactor through Pit disassembly/conversion and Pu conversion including transport of SNF to HLW repository site facility would be 1.39.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to partially completed light water reactor through Pit disassembly/conversion and Pu conversion including transport of SNF to HLW repository site would be 5.64.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to evolutionary light water reactor through Pit disassembly/conversion and Pu conversion facility including transport of SNF to HLW repository site would be: Large: 5.64 Small: 5.64.	Maximum potential fatalities from the intersite transportation of Pu from existing storage sites to U.S./Canadian border would be 4.99.
		Environmental Justice			
Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations at the DOE sites but could at a generic site.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately affect minority or low-income populations.	Impacts would not disproportionately effect minority or low-income populations.

References

U.S. Department of Energy, *Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee,* DOE/EA-0929, U.S. Department of Energy, Oak Ridge, TN, September 1994.

National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium,* National Academy Press, Washington, DC, 1994.

U.S. Department of Energy, *Disposition of Surplus Highly Enriched Uranium Draft Environmental Impact Statement,* DOE/EIS-0240-D, Office of Fissile Materials Disposition (MD-4), Washington, DC, October 1995.

U.S. Department of Energy, *Environmental Impact Statement for the Nevada Test Site and Offsite Locations in the State of Nevada,* DOE/EIS-0243, January 1996.

U.S. Department of Energy, *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling,* DOE/EIS-0161, Office of Reconfiguration (DP-25), Washington, DC, October 1995.

U.S. Department of Energy, *Summary Report of the Screening Process to Determine Reasonable Alternatives for Long-Term Storage and Disposition of Weapons-Usable Fissile Materials to be Carried Forward for Detailed Study Under the National Environmental Policy Act and Detailed Technical, Economic and Non Proliferation Analysis,* DOE/MD-0200, Office of Fissile Materials Disposition, Washington, DC, March 29, 1995.

U.S. Department of Energy, *Draft Programmatic Environmental Impact Statement for Stockpile Stewardship and Management,* DOE/EIS-0236, Office of Reconfiguration (DP-25), Washington, DC, February 1996.

THE DEPARTMENT OF ENERGY'S BUDGET REQUEST FOR FY 1997

Hearing of the Subcommittee on Military Procurement
Committee on National Security
US House of Representatives

March 12, 1996

C. Bruce Tarter, Director
University of California
Lawrence Livermore National Laboratory

RESPONSES TO QUESTIONS ASKED

1. **Dr. Curtis, in your personal opinion, do you believe the $3.7 billion budget for Weapons Activities in fiscal year 1997 is adequate? Why or why not? If additional funds were to be provided, how would you allocate those additional funds? Dr. Tarter[, do you agree]?**

The fiscal year 1997 budget for Weapons Activities is a very tight budget. The Stockpile Stewardship and Management Program, as supported by the President, requires an investment on the order of $4 billion per year for a decade. These funds are necessary to construct essential experimental facilities and to develop vital surveillance, revalidation, and remanufacturing capabilities to ensure over the long term the safety and reliability of the nuclear stockpile.

An investment of $3.7 billion in fiscal year 1997 is a barely adequate start to the Stockpile Stewardship and Management Program. I emphasized in my oral testimony the necessity of a $4 billion per year average for a decade. More money sooner would allow us to bring on line more rapidly the tools we need to maintain an aging stockpile in the absence of nuclear testing. By not beginning with a stronger start, we are increasing the risk that the Program will fall short of its objectives. It forces us to make very difficult tradeoffs among competing stewardship and management needs. The Program is a highly-integrated effort and only as strong as its weakest link. We cannot afford to underinvest in any of its major elements.

If additional upfront funding were available, I would target funds in a balanced way to a number of areas which could greatly benefit from more support this year. As I have indicated, maintaining balance in a highly-integrated program is important. For example with a 5-10% increase in overall funding, I would recommend providing a substantial boost in support to Stockpile Life Extension and Enhanced Surveillance activities together with additional funding for Dual Revalidation, Advanced Manufacturing, the Accelerated Strategic Computing Initiative, the Inertial Confinement Fusion Base Program, and DARHT construction. I would be pleased to provide more specific information about these recommendations and the associated incremental benefits if needed.

2. **[P]lease provide an overview of the most promising and challenging activities underway at your Laboratory in the area of nuclear weapons. Is supporting the nuclear weapons mission still the highest priority project, in terms of funding and management attention, at each of your respective Laboratories? If not, what is the highest priority and why?**

Lawrence Livermore National Laboratory was founded in 1952 as a nuclear weapons laboratory, and national security continues to be our central mission. Our stockpile responsibilities are our highest priority. The importance of this mission to the laboratory—and the laboratory to this mission—was reaffirmed by the President in conjunction with his decision to seek a CTBT with no nuclear weapon test explosions. Our essential role in the newly-established Stockpile Stewardship and Management Program is evident in the draft programmatic environmental impact statement (PEIS) for the Program.

The goal of the Stockpile Stewardship and Management Program is to replace a system based on development of new weapons and nuclear testing with one based on stockpile life extension and validation by non-nuclear testing and computational simulation. This is one of the greatest challenges our laboratory has faced. I could provide an extensive list of technical challenges in each project area. But perhaps one of the largest challenges falls in the area of management—integrating and balancing the efforts for various aspects of the program, and attending to the vital need for training the new generation of stockpile stewards.

Let me briefly mention a few promising Stockpile Stewardship and Management Program activities at Livermore that I discussed at greater length in my testimony:

— *The Accelerated Strategic Computing Initiative.* We are working in partnership with industry to obtain a 10,000- to 1,000,000-fold increase in computer speed and data storage capacity. This will allow us to pursue three-dimensional computer simulations and include more realism in the models, which are essential for stewardship of an aging stockpile.

- *Nova experiments and the National Ignition Facility (NIF).* This past year weapon scientists conducted more than 200 experiments with the Nova laser to study hydrodynamic instabilities and mixing, material opacity, equations of state, and other aspects of weapons physics. We have also begun the next phase of design work on the next step in scaling up from Nova, the NIF, which is a cornerstone of the Stockpile Stewardship and Management Program.

- *Plutonium experiments at Nevada.* We are preparing to conduct a series of experiments to study the properties of plutonium shocked and accelerated by high explosives. These experiments will help us understand and better model the phenomena of mixing, which affects the performance of primaries in stockpiled weapons.

- *Laser cutting in support of the W87 Life Extension Program.* A demonstration project is underway to show the feasibility of using lasers to cut high-value parts in the W87 warhead. The importance of this technology is that it not only preserves the existing part (almost no material lost in the cutting process), but it essentially eliminates the waste stream created in the traditional remanufacturing process. It promises to be cost-effective, environmentally-responsible process for future support of the stockpile.

3. **Last year some in Congress proposed to abolish DOE, in light of significant budget reductions and reported mismanagement of the Department by the Secretary of Energy. Although the Department ultimately was not abolished, there was discussion about whether or how DOE's nuclear missions could be absorbed by the Department of Defense (DOD). [W]hat are your views?**

In letters to Congress dated 29 March 1995, Secretary of Defense William Perry stated: "Over the past 50 years, there has been a clear and distinct separation of the nuclear weapons-related roles and responsibilities of the Department of Defense and the Department of Energy (and its predecessor agencies). This dual-agency approach has served the nation well by creating institutional checks and balances that are vital for meeting the performance, safety, and reliability requirements of the nuclear arsenal. With the new technical challenges of providing stewardship of the stockpile in the absence of underground testing, this is not a time to be fundamentally restructuring the management of these activities."

I concur with Secretary Perry's analysis and believe that transfer of LLNL's functions to DoD is not in the nation's best interests for several reasons. In my view, a persuasive case has not been made that significant cost savings result. I also do not see the merit in transferring DOE's unique environmental management problems to an agency with no comparable experience dealing with radiological wastes or mixed radiological and toxic wastes. Finally and most importantly to us, the transfer likely would weaken our laboratory and devalue our important contribution to nuclear security:

— *Transfer of DOE nuclear security functions to the DoD would eliminate an important set of checks and balances.* The independence of our views continues to be important now that we must certify the performance of an aging stockpile in the absence of nuclear testing. We are pursuing a new certification procedure which includes participation by the three nuclear laboratories and the DoD. Now is not the time to alter an important set of checks and balances by confining crucial technical judgments and decisions that affect national security within one executive Department.

— *Transfer of LLNL to DoD likely would weaken the multiprogram, multidisciplinary strengths of the laboratory and negatively impact our national security efforts.* Moving Livermore to DoD would separate our activities from other science research. Our nondefense scientific programs, which enhance our capability to perform our principal mission, would become detached from their prime sponsor, I believe to the detriment of their long-term health. In addition, to attract young scientists, Livermore profits from having a rich mixture of military and civilian work and both basic and applied R&D activities. For stockpile stewardship to succeed, we need the best scientific talent the nation has to offer.

4. **On August 11, 1995, President Clinton announced a decision to pursue a "zero yield" CTBT, and stated that "the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States." He also call for a new certification procedure, involving the Secretaries of Energy and Defense, the directors of the weapons laboratories and the commander-in-chief, U.S. Strategic Command. Finally, he established specific, additional safeguards that define conditions under which the U.S. could enter into a CTBT. [D]o you agree with Dr. Curtis's assessments? Did each of you in fact assure the President that the U.S. can maintain a safe and reliable nuclear deterrent without nuclear testing? Is this still your assessment? Are you confident this is the case given that the infrastructure and tools needed for stockpile stewardship will not be available in some cases for ten years or more?**

On July 3, 1993, the President tasked us to explore means other than nuclear testing for maintaining confidence in the safety and reliability of the nuclear weapons stockpile. We worked diligently under the leadership of the Department of Energy to develop a plan to establish the technical and human resource capabilities to achieve this objective. The result of that extensive effort is the Stockpile Stewardship and Management Program.

As input to the President before his decision to pursue a Comprehensive Test Ban Treaty (CTBT) with no permitted nuclear weapon test explosions, I provided my best judgment that that Program would meet its objectives if adequately funded, but that there would be risks. My assessment of program risks has not changed since the time of the decision (August 11, 1995). The stockpile is now safe and reliable; our concerns center on the impact of advanced aging on stockpiled weapons that will be relied on well beyond their planned lifetimes. Without an effective program to compensate for the absence of nuclear testing, our confidence in the stockpile would decrease over time. With an effective program which phases in new tools and capabilities as they are developed, we can minimize the risks to national security posed by an aging nuclear weapons stockpile.

We need a sophisticated set of tools to anticipate or detect physical changes in weapons, to understand the impact of these changes on weapon performance, and to take the necessary actions (preferably as preventive maintenance). We also need to bring these tools on line expeditiously. The Stockpile Stewardship and Management Program is an integrated and balanced approach to do this. It includes enhanced stockpile surveillance, a revalidation process that depends heavily on the sophisticated set of tools we are developing, and an agile manufacturing capability. We have designed the program to minimize national security risks, and it is important that the effort receive necessary funding.

The President's CTBT decision included specific safeguards "that define the conditions under which the United States can enter into a CTBT." These safeguards help mitigate the risks should the stockpile stewardship program "fall short of its objectives." It is my continuing responsibility to report to the President and to you my assessment of how the program is working.

5. **[W]hat is the link between the National Ignition Facility and the U.S. ability to maintain the U.S. nuclear weapons stockpile? How Important is NIF to being able to recruit and retain competent skilled scientists and engineers?**

The National Ignition Facility (NIF) helps us maintain confidence in the nation's nuclear weapons stockpile in several ways:

— *Experiments that directly support stockpile stewardship.* There is a set of weapons issues that have arisen in the past that were resolved on the basis of experiments done using large glass lasers such as Nova, its predecessors, and the NIF when it becomes available. Recently, Nova was used to perform experiments on issues directly relevant to the stockpile. The laser's utility, however, is limited by its size and capability. The NIF will greatly expand the number of issues which can be experimentally validated without nuclear explosive testing.

— *Experiments to validate computer simulation models.* NIF experiments will provide otherwise unobtainable data to validate our understanding of the fundamental physical processes modeled in computational simulations. Experiments using the Nova laser have already provided important insights. The NIF will greatly increase the set of conditions relevant to weapons physics for which we can validate our models. In particular, the NIF will provide a unique capability to address issues having to do with fusion burn (which occurs during nuclear explosions).

— *A "magnet" and training facility for talented scientists and engineers.* As one of the world's premiere scientific facilities, the NIF will attract the high quality scientific talent necessary to provide expert judgments about the stockpile in the future. It will be a centerpiece of our efforts to train new scientists in the skills needed to assess the stockpile in the absence of nuclear testing. In particular, scientists using the NIF will pursue nuclear-weapons-related physics and learn to integrate together the cycle of theory, computational simulation, experiment, and judgment.

6. **[A]re you concerned that funds for the new construction projects for Stockpile Stewardship will "rob" funding for so-called "core stockpile stewardship" activities? For stockpile surveillance and other management activities?**

New initiatives, including construction projects, associated with the Stockpile Stewardship and Management Program and "core stockpile stewardship" activities both have the same integrated program objective: maintenance of confidence in the safety and reliability of the stockpile. The distinction between "core" stockpile surveillance and enhanced stockpile surveillance or between ASCI and "core" computing will diminish over time as the activities blend together. Similarly, new experimental facilities will become an essential part of the "core"-program efforts when construction activities are completed. Thinking that funds for new construction projects for stockpile stewardship "rob" funding from so-called core activities misses the point of a balanced, integrated program effort.

It is vital that we make a significant investment in facilities, for both programmatic and infrastructure support, to accomplish program objectives. The decade-long plan and budget request developed by DOE Defense Programs outlines a well-integrated, balanced set of tasks and deliverables within a stable funding profile (i.e., nominally $4 billion per year). At this level of funding, Livermore will be able to fully support and constructively accomplish the necessary milestones across the broad spectrum of activities, including core stockpile stewardship and stockpile management and initiatives like ASCI and Enhanced Surveillance. New construction projects required to meet program objectives are an integral part of the plan.

7. **Congress last year cut funds for Technology Transfer activities, based on a concern that these programs provide little, if any, benefit to the nuclear weapons mission. What changes in the program have been adopted to ensure that it is focused on the primary mission of the laboratories—namely, supporting the nuclear weapons stockpile? If none, why?**

LLNL's Weapons Program established a Defense Technology Applications Program (DTAP) office at the laboratory in 1994 and assigned to it the responsibility of conducting dual-benefit assessments. DTAP has examined Livermore's existing Technology Transfer portfolio, and it examines proposed new initiatives to ensure and enhance Defense Programs' benefits from these industrial partnerships.

Livermore responded to congressional concerns and budget actions by optimizing the weapons-stockpile relevance of the FY96 Technology Transfer Program through use of DTAP's dual-benefit assessment process. Based on these assessments, FY96 actions included termination of some partnerships, modification of some Joint Work Statements to enhance weapons-program return, diminished obligations in lower ranked projects, and increased priority for highly ranked projects. In addition, several new partnerships under consideration were dropped to ensure priority focus on existing highly ranked projects. In FY96, our highest priority areas in the dual-benefit assessment process are support of the Advanced Design and Production Technology (ADaPT) initiative and the Advanced Strategic Computing Initiative (ASCI).

8. **[W]hat are the objectives of the Advanced Supercomputing Initiative (ASCI)? What is its status? How important is it to the nuclear mission and why?**

The objective of the ASCI program is to develop the computational modeling and simulation capability needed to shift from nuclear test-based methods of assuring the safety and reliability of the enduring stockpile to computational-based methods.

The ASCI program is halfway through its first fiscal year of funding. It has developed and is implementing a program plan based on a careful analysis of the needs of the nuclear weapons program (e.g., the Stockpile Life Extension Program) and how they translate into specific demands on our computational modeling capability. For example, the need to confidently predict the effect of component aging on weapon performance leads directly to requirements for improved computer performance and better models of material behavior. The computational requirements follow from the demand for three-dimensional simulations to model in detail the irregularities caused by aging effects.

The development and continued evolution of our Needs/Capabilities matrix is critical to ensuring the success of both ASCI and the Stockpile Stewardship and Management Program. Early accomplishments of ASCI include:

— Establishment of the first computer vendor partnership (with Intel), and initiation of the selection process for other vendor partnerships, to develop the very high performance supercomputers to meet the needs of the weapons program.

— Development of "rapid prototype" weapon-physics simulation models to give our weapon scientists early access to new levels of capability and guide follow-on work leading to more fully developed simulation codes.

— Establishment of a high speed, classified network linking the three Defense Programs' laboratories to support integrated, multi-lab programs and permit the sharing of information and computing resources.

ASCI is critical to the nuclear mission. In the absence of nuclear testing, computational modeling is the only means by which archived nuclear test data, experimental data from new experimental facilities, and improved understanding of the fundamental physics of nuclear weapons can be applied to the problem of assuring the safety, reliability, and performance of the enduring stockpile—ASCI is the key integrating element of the Stockpile Stewardship and Management Program. It is the tools and capabilities developed by ASCI that will be used to decide when and what modifications to weapons in the enduring stockpile are required and their impact on weapon safety, reliability, and performance.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 1

FISCAL YEAR 1996 BUDGET REQUEST HIGHLIGHTS

Mr. Hunter: Dr. Curtis, in your personal opinion, do you believe the $3.7 billion budget for Weapons Activities in fiscal year 1997 is adequate? Why or why not? If additional funds were to be provided, how would you allocate those additional funds? Do you agree Dr. Smith?

Dr. Smith: I concur with Mr. Curtis' statement that, for FY 1997,$3.7 billion is sufficient to support core stockpile stewardship and management activities. We must continue our support to both core activities and the new facilities that DoE envisions to provide new sources of data to offset the loss of underground nuclear testing.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 2

DOE'S PLANS FOR RE-STARTING TRITIUM PRODUCTION

Mr. Hunter: The Department's plan calls for pursuing both the accelerator option and the commercial light water reactor option until 1998, when both a "leader" technology and a "backup" technology would be selected. DOE rejected the use of a privatized, multipurpose (or "triple play") reaction that would produce tritium, burn plutonium, and produce electricity for the local/regional power grid.

Dr. Smith, what is the DoD position on the appropriate technology for producing tritium? on the date by which a new tritium production source must be on-line?

Dr. Smith: The Department fully supports the Dual-Track Tritium Supply Strategy proposed by the Department of Energy. This strategy was endorsed by the Nuclear Weapons Council and will develop two sources of tritium; however, the decision on the primary source will not be made until 1998. If the Accelerator is chosen, we can expect tritium by 2007. If tritium is needed sooner, we can turn to commercial light water technology for this critical ingredient.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 3

DOE'S PLANS FOR DOWNSIZING AND MODERNIZING THE NUCLEAR WEAPONS PRODUCTION COMPLEX

Mr. Hunter: DoE's plan calls for reducing the size of the nuclear weapons design and production complex by four-fifths (as compared to the size of the complex at the height of the Cold War). The plan proposes to downsize the four industrial sites (Savannah River Site, Kansas City Plan, Pantex Plant, and Oak Ridge Reservation) while maintaining their role in supporting the needs of the smaller remaining nuclear weapons stockpile. Additional capabilities are proposed for the weapons design laboratories (Los Alamos, Lawrence Livermore, and Sandia) to support science-based stockpile stewardship.

Dr. Smith, is the DoD satisfied with DoE's plans in the area of plutonium pit production and refabrication of warheads? With DoE's overall plan for Stockpile Stewardship and Management? Why or why not?

Dr. Smith: DoD is working closely with DoE to develop a plan that meets all the requirements in the Nuclear Posture Review -- including pit production and warhead refabrication. We believe that the modernized complex will meet our needs, and we have the Stockpile Stewardship and Management process to voice and monitor our needs.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 4

TRANSFERRING DoE NATIONAL SECURITY FUNCTIONS To DoD

Mr. Hunter: Last year some in Congress proposed to abolish DoE, in light of significant budget reductions and reported mismanagement of the Department by the Secretary of Energy. Although the Department ultimately was not abolished, there was discussion about whether or how the DoE's nuclear missions could be absorbed by the Department of Defense (DoD).

Dr. Smith, when will the Congress receive the report on the Nuclear Posture Review and on plans for nuclear weapons management in the event of the abolition of the Department of Energy, as required by Section 907 of the National Defense Authorization Act for Fiscal Year 1996 (Public Law 104-106)?

Dr. Smith: Secretary Perry signed the report on April 17, 1996, and it was forwarded to the appropriate committees shortly thereafter.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 5

TRANSFERRING DOE NATIONAL SECURITY FUNCTIONS TO DOD

Mr. Hunter: Dr. Smith, is there any reason why the Department of Defense could not responsibly perform this mission, if the Congress so directed such a change?

Dr. Smith: The Secretary's April 17, 1996, report to Congress is clear on this matter.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 6

CHANGES IN DOD ORGANIZATION AND OVERSIGHT OF NUCLEAR MATTERS

Mr. Hunter: Dr. Smith, we understand that you have recommended changes in DoD's organization for nuclear matters, including enhancing the role of the Defense Nuclear Agency. What are these proposed changes, and when do you propose to implement them? Why was Congress not advised in advance of these recommended changes?

Dr. Smith: The Defense Nuclear Agency (DNA) has traditionally supported the Nuclear Matters staff on tasks that require more manpower than my office staff can dedicate at any one time. The administrative changes that I have made should enhance coordination and effectiveness within my organization. I did not consider them to be of sufficient scope to advise Congress.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 7

THE PRESIDENT'S DECISION ON A "ZERO YIELD" COMPREHENSIVE TEST BAN TREATY (CTBT)

Mr. Hunter: On August 11, 1995, President Clinton announced a decision to pursue a "zero yield" CTBT, and stated that "the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States." He also called for a new certification procedure, involving the Secretaries of Energy and Defense, the directors of the weapons laboratories and the command-in-chief, U.S. Strategic Command. Finally, he established specific, additional safeguards that define conditions under which the U.S. could enter into a CTBT.

Drs. Curtis and Smith, please describe for us the new certification procedures announced by the President. When and how will they be implemented? What sort of expertise does the DoD have, and in particular does STRATCOM have, to help make a judgment on an annual basis as the safety and reliability of the nuclear stockpile? Does this certification procedure also include an appraisal of the health of the stockpile stewardship and management program? Why or why not?

Dr. Smith: My staff is coordinating the implementation of a mutually agreeable format for this important new procedure. I expect it to be submitted to the Nuclear Weapons Council later this Spring, with the first annual certification report to be released in late Summer or early Fall. The STRATCOM Advisory Group (SAG) will be CINCSTRAT's primary source of expertise for technical issues related to annual certification. The two independent efforts will, however, share data and information from the technical experts from the National Laboratories and the operational experts from the Services to form the basis of a recommendation to the Secretary on certification of each weapon in the stockpile. The effectiveness of stockpile stewardship will be reviewed for each weapon.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 8

THE PRESIDENT'S DECISION ON A "ZERO YIELD" COMPREHENSIVE TEST BAN TREATY (CTBT)

Mr. Hunter: Drs. Smith and Curtis, how can we be sure that the Secretaries of Defense and Energy will feel free to announce that there is a problem with the stockpile, if that announcement also means that the US will be forced to withdraw from an international treaty? Won't there be tremendous pressures to find "work-arounds" or sweep problems under the rug so as to avoid having to invoke the "supreme national interests" clause in the CTBT and withdraw from it? Why or why not?

Dr. Smith: The annual certification process will combine data from a variety of sources including a broad spectrum of scientists, engineers, and operators. The process is being designed so that no one segment of the community can hide potentially damaging information from the rest. Additionally, the Dual Revalidation program will take an in-depth look at every active weapon in the stockpile. The scientists involved in Dual Revalidation would be able to commit additional time and resources to identifying and rectifying problems that could act to "de-certify" a weapon type in the stockpile. The consequences of ignoring a potential problem could endanger the national security of our country. The National Weapons Laboratories, the Department of Energy, US Strategic Command, Joint Staff, the Services, and the Department of Defense are aware of the implications of the decisions made under the auspices of this important new program and take their management responsibilities seriously.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 9

NUCLEAR WEAPONS STOCKPILE MEMORANDUM (NWSM)

Mr. Hunter: Dr. Smith, is DoD satisfied with the contents of the Memorandum? Does the Memorandum adequately address DoD requirements and the requirements in the Nuclear Posture Review? Does the Commander-in-Chief, US Strategic Command, concur with your assessment?

Dr. Smith: The Department of Defense is satisfied that the Fiscal Year 1996 Nuclear Weapons Stockpile Memorandum (NWSM) addresses the requirements of the Nuclear Posture Review, particularly the "lead and hedge" strategy. The NWSM was approved by the Nuclear Weapons Council after having been thoroughly coordinated throughout OSD, Joint Staff, and the Services, including Strategic Command.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 10

STOCKPILE STEWARDSHIP ISSUES

Mr. Hunter: Dr. Smith, your testimony cites the need to "establish methods to measure success of the Stockpile Stewardship and Management program at specific intervals." How and when will this be accomplished?

Dr. Smith: Like the Stockpile Stewardship and Management program itself, the methods for measuring the success of the program and the intervals for reviewing performance, metrics, have yet to be finalized. The Departments of Defense and Energy are working together to develop metrics for the program, and will have them defined prior to the completion of the final Stockpile Stewardship and Management program plan, projected to be later this summer.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 11

NEVADA TEST SITE

Mr. Hunter: Dr. Smith, does the DoD perform much work at the Test Site? If so, what type of work and why is it performed there? Does DoD reimburse DoE for activities it conducts at the Test Site?

Dr. Smith: The Department of Defense currently conducts a number of programs at the Nevada Test Site, most of which are under the auspices of the Defense Nuclear Agency. The programs range from conventional weapons tests to ordnance demilitarization experiments, and are conducted at the test site to take advantage of the remoteness, geology, existing infrastructure, and security. DoD reimburses DoE for all services and thereby contributes to maintenance of the infrastructure at the site.

QUESTION FOR THE RECORD
HOUSE NATIONAL SECURITY COMMITTEE
SUBCOMMITTEE ON MILITARY PROCUREMENT
BUDGET REQUEST TO SUPPORT THE NUCLEAR STOCKPILE
MARCH 12, 1996

QUESTION NUMBER 12

SERVICE INVOLVEMENT IN NUCLEAR MATTERS

Mr. Hunter: Dr. Smith, we understand that Navy has a single point-of-contact on nuclear weapons matters (that is, the Director of Strategic Systems Programs) and has been actively involved in the decision-making process on nuclear issues. On the other hand, the Air Force does not have a single point-of-contact and has been relatively uninvolved in the process. What should we make of this state of affairs? Are there ways of improving the Air Force's oversight of and involvement in nuclear weapons matters? If so, please share your ideas for accomplishing this objective with the Committee.

Dr. Smith: In fact, a single Air Force point-of-contact does exist in Major General Bobby Floyd, Director of Forces. The Air Force nuclear weapon mission encompasses seven different weapons on a variety of platforms (ICBMs, cruise missiles, bombers, fighters). When inactive and retired weapons are considered, Air Force responsibility extends to ten different nuclear weapon types. The size of the Air Force mission leads to the perception that the Air Force does not have a single point-of-contact. I am satisfied that Major General Floyd through the Nuclear Weapons Council Standing and Safety Committee is providing the leadership that is paramount to maintaining the Air Force oversight and involvement in nuclear weapon matters.

Answers to Written Questions
Committee on National Security, Military Procurement Subcommittee
U.S. House of Representatives
March 22, 1996

Dr. C. Paul Robinson, Director
Sandia National Laboratories

Fiscal Year 1996 Budget Request Highlights

1. Drs. Robinson, Hecker, and Tarter, please provide an overview of the most promising and challenging activities underway at your Laboratory in the area of nuclear weapons. Is supporting the nuclear weapons mission still the highest priority project, in terms of funding and management attention, at each of your respective Laboratories? If not, what is the highest priority and why?

Response:

I can assure the Committee that the nuclear weapons mission, which is made up of direct weapons activity and the supporting core program, receives the highest priority at Sandia National Laboratories, both in terms of funding and management attention.

The major challenges we face are how to develop and sustain the fundamental knowledge base needed to ensure the reliability of an aging stockpile over the long term, and how to maintain the skills and capability to respond to future requirements. This job is more difficult than it was in the past for several reasons:

- No new weapon development work is anticipated.
- Weapon services lives must be extended two or three times beyond their designed service lives.
- The post-START II stockpile will be less diverse, increasing the risk of a common-mode technical failure.
- Funding for the weapons R&D Program has fallen by half over five years.
- Tests of nuclear weapons will be prohibited.
- We are losing the design expertise of senior nuclear-weapons engineers as they retire.

The laboratories are pursuing several promising activities in the nuclear weapons program, in addition to the Science-Based Stockpile Stewardship initiative, that can help us meet this challenge. We have instituted a knowledge retention program aimed at recording as much of the design expertise of senior designers as is practical. A dual revalidation program for every weapon in the stockpile will familiarize new personnel with older systems. System life extension programs and stockpile improvement programs help provide some level of weapons engineering experience. We have also begun a long-term Warhead Protection Program to exercise and preserve weapon design, research, development, and certification skills for future requirements. It is through processes such as these that we intend to balance major capital initiatives, systems needs, technology developments, and the core program.

DOE's Advanced Supercomputing Initiative is a promising effort because it will give us new capabilities for stockpile stewardship in the absence of the methods we relied on in the past. Model-based simulation of various phenomena during the weapons life-cycle will be a powerful tool for predicting stockpile problems and developing timely solutions. New microelectronic sensors and nondestructive evaluation techniques also hold promise for enhancing our surveillance capabilities.

The aboveground experimental program holds long-range promise as a tool for stockpile stewardship with respect to the reliability and safety of nuclear explosives in the absence of underground stockpile confidence tests. At Sandia, we recently achieved a remarkable advance in our pulsed-power inertial confinement fusion effort that is very encouraging for the long-range potential of this program.

Transferring DOE National Security Functions to DoD

Last year some in Congress proposed to abolish DOE, in light of significant budget reductions and reported mismanagement of the Department by the Secretary of Energy. Although the Department ultimately was not abolished, there was discussion about whether or how the DOE's nuclear missions could be absorbed by the Department of Defense (DoD).

2. Drs. Hecker, Robinson, and Tarter, what are your views on this matter?

Response:

In my opinion, a dual-agency responsibility for nuclear weapons should be retained. Under this arrangement, the civilian agency and its laboratories can exercise independent technical judgment with respect to safety, use control, and other facets of nuclear weapon research and development. This separation of duties is reflected in the Annual Surety Report to the President, which requires approval from both DoD and DOE, providing checks and balances for surety versus operational concerns.

Historically, laboratory directors have been known to take positions on stockpile issues that were, at times, at odds with positions advocated by the military services. For example, in the early 1960s, Sandia and the University of California's Radiation Laboratory (the precursor to Lawrence Livermore National Laboratory) pushed for the implementation of use-control devices on nuclear weapons in the face of adamant resistance by the services. In 1990, the directors of the DOE defense programs laboratories expressed concerns before Congress about the operational safety of the W69 Short Range Attack Missile as then deployed. Their testimony brought into sharp focus the difficulties that can arise when safety considerations conflict with military utility.

It has been argued that a nuclear programs agency reporting directly to the secretary of defense could maintain a position of independence from the military services with respect to nuclear weapon safety design and control issues. That is possible, but not probable. The atomic energy efforts in the former Soviet Union reported to the Ministry of Defense and, as a result, no technical use-control devices were incorporated in their devices, preferring to rely on "guns and guards" instead. Tradeoffs concerning budgetary support of the nuclear weapons laboratory and production infrastructure versus military operational requirements could well endanger the technology base that is essential for a safe stockpile.

In my opinion, the proposal to transfer nuclear weapon design responsibility to the Department of Defense is not the best course. We support efforts to streamline government management and oversight, whether within the DOE or some other management. However, we will always do our utmost to assure that the nation's nuclear deterrent remains reliable, safe, and secure, regardless of our agency affiliation.

The President's Decision on a "Zero Yield" Comprehensive Test Ban Treaty (CTBT)

On August 11, 1995, President Clinton announced a decision to pursue a "zero yield" CTBT, and stated that "the maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States." He also called for a new certification procedure, involving the Secretaries of Energy and Defense, the directors of the weapons laboratories, and the commander-in-chief, U.S. Strategic Command. Finally, he established specific, additional safeguards that define conditions under which the U.S. could enter into a CTBT.

3. Drs. Tarter, Hecker, and Robinson, do you agree with Dr. Curtis' assessments? Did each of you in fact assure the President that the U.S. can maintain a safe and reliable nuclear deterrent without nuclear testing? Is this still your assessment? Are you confident this is the case given that the infrastructure and tools needed for stockpile stewardship will not be available in some cases for ten years or more?

Response:

Let me be clear about what I and my colleagues Dr. Hecker and Dr. Tarter stated to the White House last August.

We said that we could "meet the challenge" of maintaining the nation's nuclear deterrent under a comprehensive test ban *if* we vigorously pursue a program of science-based stockpile stewardship. We did not provide an absolute guarantee that we could meet that challenge. In the absence of a strong commitment to science-based stockpile stewardship, we believed that success would be unlikely; nor did we know of any better alternatives. We were realistic in telling the administration that the quest to find a substitute for the role of nuclear testing cannot be pursued without an increase in funding. The President made three commitments in this regard: adequate funding, an annual joint review of certification, and identification of "the maintenance of a safe and reliable nuclear stockpile" as a "supreme national interest of the United States."

It is true that the new facilities and computational tools we will need for science-based stockpile stewardship will not be fully developed for several years. It is also true that the core research and development program must be sustained at a level commensurate with the nation's commitment to a nuclear deterrent. Consequently, it is especially important that the research and development of the capabilities required for science-based stockpile stewardship be aggressively pursued from this moment. I do have some concern that the resources made available over the long term may be insufficient to support initiatives associated with both the science-based stockpile stewardship program and the research and development capabilities essential to the maintenance of the stockpile.

Stockpile Stewardship Issues

4. Drs. Reis, Hecker, Tarter, and Robinson, are you concerned that funds for new construction projects for Stockpile Stewardship will "rob" funding for so-called "core" stockpile stewardship activities? For stockpile surveillance and other management activities?

Response:

It is imperative that we maintain a robust capability in the core scientific and engineering programs required for the ongoing surveillance and support of nuclear weapons in stockpile. Great care must be taken so that we do not permit the reliability and surety of the existing U.S. nuclear weapons stockpile to erode while we attempt to construct and develop the facilities and tools necessary for long-term, science-based stockpile stewardship. Sufficient funds must be allocated both to sustain the core program and to make the new investment in special facilities that will be required to perform our work in the absence of underground nuclear tests. This was the basis of our understanding with the President.

In my view, "robbing" the core programs of stockpile stewardship, management, and support to finance new facilities and programs for science-based stockpile stewardship would be unacceptable.

5. Drs. Reis, Hecker, Robinson, and Tarter, Congress last year cut funds for Technology Transfer activities, based on a concern that these programs provide little, if any, benefit to the nuclear weapons mission. What changes in the program have been adopted to ensure that it is focused on the primary mission of the laboratories—namely, supporting the nuclear weapons stockpile? If not, why not?

Response:

With the funding reduction in the defense programs Technology Transfer Initiative in FY96, we reviewed our portfolio of 120 cooperative research and development agreements (CRADAs) and made substantial changes. Seven agreements were canceled; 62 were scaled back. In determining which agreements to cancel, which to curtail, and which to continue at current funding levels, a primary criterion was the relative benefit to the laboratory's defense programs mission. We also tried to avoid disrupting industrial relationships that are important to the weapons program.

It is our policy to review all proposals for cooperative research and development to ascertain that the laboratory's technology base for defense programs will benefit. Each CRADA specifies its benefit for DOE, and each is approved by DOE before the laboratory performs any work with the partner.

The strategic purpose of a cooperative project is frequently quite different for the industrial partner and the laboratory. Consequently, CRADAs have often supported commercial end-use applications with no apparent utility to the nuclear weapons program. The science and engineering involved in the performance of a cooperative project—and not its end use —is the source of relevance to the nuclear weapons program. This strategy has permitted us to leverage diminishing DOE resources and help maintain and enhance our core technical capabilities.

We have added no new projects under the Technology Transfer Initiative program in the last two years. Future cooperative work will require that end-use applications be more strongly aligned with the defense programs mission, as well as with the core science and engineering requirements of the nuclear weapons program.

6. Drs. Reis, Hecker, Tarter, and Robinson, what are the objectives of the Advanced Supercomputing Initiative (ASCI)? What is its status? How important is it to the nuclear mission, and why?

Response:

DOE's Advanced Supercomputing Initiative (ASCI) is obviously of fundamental importance to the nuclear design laboratories, but it is also vitally important to Sandia. Many of the long-term reliability issues associated with an aging stockpile cannot be understood without the advanced simulation and modeling capability that ASCI will provide.

Stockpile aging phenomena must be modeled at both the molecular and systems levels. Computational simulations will permit us to predict and preempt stockpile problems that can affect the performance, safety, and reliability of nuclear weapons through the decades. We will be able to plan replacement and refurbishment activities in an optimum and cost-effective manner. In this way, we can mitigate the risks associated with an aging stockpile. Without ASCI, we will not fully understand the risks of an aging stockpile.

The Advanced Supercomputing Initiative is essential for stockpile confidence in the absence of nuclear testing. Aboveground experimental facilities and valid computational models must be developed in tandem. Sandia's recent advance in pulsed-power inertial confinement fusion provides crucial experimental data for improving physics models. Conversely, computational simulation helps guide the development of the experimental facilities.

The first step in ASCI has been a partnership led by Sandia and INTEL Corporation to develop the world's first teraflop computer. This project, which builds on previous INTEL partnerships with Sandia and Oak Ridge national laboratories, will produce a computer with over 9,000 individual processors tightly coupled together. It will have ten times the memory and ten times the speed of any previous computer. This machine will be immediately useful for detailed safety, aging, and nuclear performance studies made necessary by real stockpile problems we are dealing with today. It will also be used by the three laboratories to develop and test the highly detailed software models needed to perform the defense programs mission in a future environment of no nuclear testing and a smaller, older stockpile. Follow-on machines and software models will provide increasingly useful tools for maintaining nuclear weapons reliability, safety, and performance.

Written Statement

Submitted to the

Subcommittee on Military Procurement

of the

U.S. House of Representatives

Committee on National Security

Concerning the Subjects of

Tritium Production & Plutonium Disposition

By

George A. Davis
Project Manager, System 80+ Deployment, U.S.
ABB Combustion Engineering Nuclear Systems
Windsor, Connecticut

March 14, 1996

ABB Combustion Engineering, has teamed with seven other companies and proposed a plan to the Department of Energy for the deployment of a privatized multipurpose reactor facility on DOE's Savannah River Site. We originally developed an interest in this concept in late 1992, when the Armed Services Committee requested that DOE consider the possibility of a multipurpose reactor that could (1) produce tritium, (2) consume excess weapons plutonium as fuel, and (3) generate electricity, as a way to offset the government's costs.

In March 1994 we submitted to DOE a Program Plan for organizing a consortium that would privately finance, build, own, and operate the multipurpose reactor facility on DOE's Savannah River Site. The facility would consist of two System 80+ standardized units, along with a fuel manufacturing building. The consortium would be formed as an Independent Power Producer that would contract to sell electricity to utilities throughout the Southeastern U.S. and contract with DOE to provide two services: irradiation of tritium-producing targets and disposition of excess weapons plutonium, by consuming it as fuel. Besides minimizing the government's costs, this has the distinct advantage that it allows the government to avoid billions of dollars in outlays to build new facilities for production of tritium and disposition of plutonium over the next ten years. Instead, the engineering, licensing, and construction would be done with private financing. DOE would then begin paying fees for services rendered, after the facility goes operational.

We estimate that the electricity sales would cover about 90% of the costs. The remainder would be charged to DOE for the services that it receives. Since the plutonium disposition mission can be well defined up-front, before DOE has to make contractual commitments, we proposed that DOE pay a fixed annual fee for disposition of excess weapons plutonium -- currently estimated at $78 million per year in constant 1995 dollars.

Since the long term needs for tritium production are not as easily defined, and may be subject to change, we proposed that DOE pay a variable annual fee for irradiating targets. The fee would cover lost electricity sales, if any, when tritium is being produced. To produce tritium at the rate of 3/8 of the 1988 goal (DOE's current upper limit estimate), we estimate the variable fee could be as high as $53 million per year. However, if no tritium were being produced, then no fee would be have to be paid. This gives DOE the maximum flexibility in contracting for the service. Compared to the alternative of DOE building a new dedicated facility for tritium (e.g., the accelerator), our approach avoids the risk that billions of dollars might be spent to build a facility and then later find that it is no longer needed, or is incorrectly sized.

In September 1995, we submitted an Alternate Plan to DOE -- to address the Department's concerns about the difficulty in establishing long term power sales agreements with utilities. The Alternate Plan focuses upon the use of a single System 80+ reactor and a greatly simplified method of selling electricity from the plant.

In its Record of Decision on Tritium Production in December 1995, DOE announced that it would pursue a parallel track for the next three years to (1) continue research & development of an accelerator, and (2) evaluate the use of one or more of the existing 110 commercial nuclear plants that are currently operating in the United States. DOE's decision acknowledged that the existing reactor option would have the least cost, least risk, shortest schedule, and minimum environmental impact. However, because of concerns about adopting a policy that allows production of nuclear weapons material in commercial nuclear plants that were originally constructed for purely peaceful purposes, DOE felt justified in pursuing the accelerator research, in parallel. Press reports and internal DOE documents indicate that DOE plans to devote 85 to 90% of its tritium budget, over the next several years, for the accelerator research.

In its decision, DOE dropped any further consideration of a new ALWR for this mission, even though its own consultant's estimate shows that a new large ALWR (using our System 80+ design as a reference) would likely cost the federal government about $12 billion less to build and operate than the accelerator, in undiscounted 1995 dollars. For reference, the consultant estimated that the accelerator will cost between $12 billion and $27 billion to design, construct, and operate (also in undiscounted 1995 dollars) -- at the 3/8 goal tritium production rate.

On top of this, we have notified DOE that we believe that there are a number of errors in the consultant's analyses and that the cost difference between the ALWR and the accelerator is even greater than the consultant calculated. Although DOE has provided responses, they have not adequately addressed our concerns and we believe that our original comments remain valid.

DOE also dropped any consideration of our proposed new privatized multipurpose reactor, even though its Record of Decision noted that one of its own laboratories, Oak Ridge, had provided a cost estimate which showed that our concept would cost the federal government billions of dollars less than DOE's estimate for the accelerator, while also fulfilling another DOE need -- the disposition of excess weapons plutonium. (As a side note, the Oak Ridge analysis was performed in response to a request from the Energy & Water Appropriations Conference Committee -- which had asked DOE to evaluate the feasibility of a multipurpose ALWR, during the FY-95 budget process. The report was due to the Committee a year ago this month. Although the draft report was completed on schedule, DOE has still not released it to Congress.)

In spite of the dramatically higher cost for the accelerator, DOE justified the accelerator's selection over a new ALWR on the basis that the accelerator has less environmental impact and less licensing risk. However, both of these arguments are fallacious. DOE's assertion that the accelerator has less environmental impact than a new ALWR is fatally flawed because DOE failed to include the environmental impact of generating the 300 to 600 Megawatts of electricity that the accelerator will require during operation. Its inclusion would show that the new ALWR has less environmental impact than the accelerator -- especially when it is also acknowledged that the new ALWR will avoid the need for an equivalent amount of fossil fueled electric generating capacity in the region, thus, creating an environmental benefit. We strongly suspect that DOE's segmentation of the accelerator's environmental impact is not consistent with the National Environmental Policy Act and could make the accelerator vulnerable to court challenge, at some time in the future, by those who do not want tritium production to be restarted.

On the subject of licensing risks, it appears that DOE has not given due credit to the "one step licensing" provisions provided in the 1992 Energy Policy Act. It is now possible to obtain the permits to both build and operate a new ALWR nuclear plant before construction is even started. Furthermore, we are talking about using a standardized ALWR plant design that has already been reviewed and certified by the NRC. DOE has invested about half a billion dollars in the ALWR program during the last decade, in cost-share with the nuclear industry, with the primary goal to receive NRC Certification of these safer, new reactor designs. In an ironic and bizarre twist of fate, DOE is now saying that these designs are not acceptable for use by DOE -- even though their own cost analyses show the ALWR to be less expensive than the accelerator that they selected. Concerning licensing of the accelerator, it should be noted that DOE recently announced plans for seeking outside regulation of all its facilities. There are no current licensing guidelines or processes for licensing an accelerator like the one proposed for tritium production. This is true licensing uncertainty. In the end, DOE will run the same risks of intervenor challenges, during licensing of a new tritium production facility, from those groups opposed to resumption of tritium production -- no matter which technology is used.

We strongly encourage the Committee to provide guidance to DOE to reconsider its decision, so as to include a lower cost option for a new facility: a large ALWR, especially a privatized multipurpose reactor, on a government site.

ABB

March 15, 1996

The Honorable Hazel O'Leary
Secretary of Energy
Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Madam Secretary:

We have sent several letters to you and other Department officials, expressing concerns about the recent Record of Decision (ROD) on Tritium Production and the documents that support it. After receiving written replies, we met with representatives of the Department and its consultant, Putnam, Hayes, & Bartlett (PHB). Although we appreciate the Department's past efforts, we must report that this interaction has failed to resolve any of our concerns and that our original comments remain valid. We do not believe that the ROD was justified in deleting the new reactor alternatives, while proceeding with the accelerator as the only technology for a new facility.

We believe that DOE's formal ROD on tritium production is technically and legally deficient in several areas:

1. The Department's Programmatic Environmental Impact Statement (PEIS) did not comply with the requirements of the National Environmental Policy Act (NEPA). Attached is a legal analysis of the PEIS and ROD, prepared by the law firm Egan & Associates. It is preceded by a two page summary.

2. The failure to comply with NEPA will make the accelerator vulnerable to legal challenge and delay, at any time during its implementation. This is also explained in the attached legal analysis.

3. In DOE's own financial analyses (including analyses by its consultant, PHB), the accelerator is shown to cost the federal government many billions of dollars more than a new, electricity-generating nuclear reactor facility. We have already submitted several letters which explain that the cost gap between the accelerator and the Large Advanced Light Water Reactor (ALWR) is even larger than calculated by DOE and its consultant.

Asea Brown Boveri Inc.

Post Office Box 500
2000 Day Hill Road
Windsor, CT 06095-0500

Telephone (860) 688-1911
Fax (860) 285-9512
Telex 99297 (COMBEN WSOR)

4. In asserting that a new reactor facility would incur a greater risk of regulatory delay than the accelerator, the ROD ignores (a) the reactor licensing improvements in the 1992 Energy Policy Act, (b) the prior approval and certification of ALWR designs by the Nuclear Regulatory Commission, in which DOE itself has invested on the order of $500 million, and (c) the proven status of reactor technology & licensing procedures versus accelerator technology & licensing procedures.

Like you, we would like to see the tritium mission accomplished with minimal impact on the environment, at the least cost to the government, and using the most reliable technology available. Unfortunately, the deficiencies in the ROD have led the Department to the wrong conclusions. Any one of these deficiencies should be sufficient to justify re-opening the Tritium ROD. Taken together, they paint a very clear picture that the Department's decision to drop any further consideration of the new reactor option, while pursuing research on the accelerator, is neither justifiable nor sustainable.

We, therefore, request that the Department reconsider its ROD and include the new reactor option.

If you have any questions on these issues, please feel free to contact me at (860) 285-5207.

Sincerely,

George A. Davis

George A. Davis
Project Manager
System 80+ Deployment, U.S.

cc: Charles Curtis, Deputy Secretary
Robert Nordhaus, General Counsel

EGAN & ASSOCIATES, P.C.
Counselors at Law

DOE's RECORD OF DECISION ON TRITIUM SUPPLY:

FATAL FLAWS IN THE ENERGY DEPARTMENT'S ENVIRONMENTAL IMPACT STATEMENT AND DECISION PROCESS

On December 5, 1995, the Department of Energy (DOE) released its Record of Decision (ROD) on its Programmatic Environmental Impact Statement (PEIS) evaluating tritium supply and recycling for the nation's remaining nuclear weapons. In selecting an unproven, more expensive accelerator as one of the preferred methods for producing tritium, DOE relied on an environmental impact analysis that is technically and legally flawed. While admitting that reactor options offer the greatest assurance of meeting the nation's tritium supply needs in a timely and cost-effective manner, DOE nevertheless chose the accelerator as a preferred alternative due, in large part, to the supposed environmental benefits of this technology. But DOE's conclusions in this regard are premised on flawed legal assumptions and methodologies.

These flaws make the PEIS subject to legal challenge under the National Environmental Policy Act (NEPA) at any time during the next decade or more -- challenges that will be launched on the basis of solid U.S. Supreme Court precedent altogether ignored by DOE. Because NEPA contains no statute of limitations on such challenges, DOE has placed the nation's nuclear stockpile at the mercy of any opponent who can write a modest memorandum of law and file it with a short complaint in federal district court. Courts have the power and the duty to enjoin DOE's actions for NEPA violations, and have done so frequently in the past.

First Flaw: Illegally Segmenting the Environmental Impacts of the Accelerator's Immense Power Supply

Although DOE evaluated the environmental impacts associated with the accelerator alone and compared the impacts with those arising from alternative tritium supply sources, DOE failed to include the accelerator's largest environmental impacts in its comparative analysis. In comparing the accelerator with existing or new commercial reactors, DOE ignored the environmental impacts associated with providing up to 600 megawatts of electricity DOE says will be needed to power the accelerator. This is equivalent to ignoring the impacts of an entire intermediate-sized coal-fired power plant, or of a large combined cycle gas-fired power plant.

This is no small error. No utility could add a 600-megawatt power plant to its system without first performing an environmental comparison of all reasonable alternatives. In recent state utility rate cases where utilities' integrated power resource plans were the subject of intensive litigation, nuclear reactors fared extremely well vis-a-vis coal- and gas-fired alternatives on comparative environmental grounds -- even when the impacts of possible severe accidents, spent nuclear fuel, and environmental "externalities" were properly included in the analysis.

Had the environmental impacts of the accelerator's huge power demands been factored into DOE's impact analysis, the accelerator option would have fared poorly against either the existing or the new multipurpose reactor options for producing tritium. By failing to include the accelerator's power supply impacts, and deferring such an analysis to a site-specific study commenced long after program funds have been irrevocably committed, DOE committed illegal "segmentation" of its analysis under the National Environmental Policy Act (NEPA), as implemented by applicable regulations and construed by the U.S. Supreme Court.

Under NEPA, environmental impact statements must include analysis of the potentially adverse environmental effects of all important aspects of a project; such analysis cannot be avoided by "terming an action temporary or by breaking it down into small component parts." Federal regulations implementing NEPA require that an EIS consider "connected actions" that are "interdependent parts of a larger action and depend on the larger action for their justification." A "hard look" at "secondary impacts" is required under NEPA.

By artificially removing the largest environmental impacts from its analysis of the accelerator, DOE has sharply and wrongly reduced the impacts of the accelerator, unfairly tipping the environmental balance against competing and less-expensive reactor options.

Second Flaw: Ignoring the U.S. Supreme Court's Ruling on Spent Fuel Impacts

The selection of an accelerator rather than a new reactor rests in large part on DOE's determination that a new reactor's spent fuel production is a key environmental discriminator. Since accelerators do not produce spent fuel and new reactors do, DOE concluded that an accelerator is preferred on this basis. DOE's conclusion is incorrect, and runs directly contrary to U.S. Supreme Court precedent.

For many years, the U.S. Nuclear Regulatory Commission (NRC) has evaluated the environmental impact associated with the storage of spent fuel from an individual nuclear power plant, and has reached the determination that, for purposes of NEPA, the effects are not critical. Therefore, NRC determined that it is unnecessary and inappropriate for other federal agencies to reassess the impact of spent fuel storage each and every time an EIS involving a nuclear power plant is conducted. The NRC promulgated regulations accordingly, and those regulations are binding on federal agencies. The validity of those NRC regulations has been upheld by the U.S. Supreme Court, which stated that for purposes of conducting an EIS evaluating the environmental impact of a nuclear power plant, the environmental impacts of additional spent fuel production shall not be assumed to be significant.

DOE was apparently unaware of this 1983 Supreme Court precedent. Thus, DOE erroneously concluded, in a vacuum relative to federal law and innumerable nuclear licensings, that the new reactor should be penalized relative to the accelerator because it will produce spent fuel.

Other Flaws: Demonstrating a Bias Against Nuclear Energy

Many other aspects of DOE's study weigh heavily and unfairly against nuclear energy. For example, in evaluating institutional and regulatory risk, DOE apparently gave no credit for the one-step licensing process approved by Congress with the Energy Policy Act of 1992. DOE gave no credit for the existence of NRC-certified advanced nuclear plant designs, which DOE has expended hundreds of millions of dollars to help develop and gain NRC approval. Conversely, DOE ignored the regulatory obstacles associated with NRC licensing of an accelerator, and with construction of a large power supply.

EGAN & ASSOCIATES, P.C.
Counselors at Law

DOE's RECORD OF DECISION ON TRITIUM SUPPLY:

FATAL FLAWS IN THE ENERGY DEPARTMENT'S ENVIRONMENTAL IMPACT STATEMENT AND DECISION PROCESS

A LEGAL ANALYSIS OF THE SECRETARY'S DECISION

March 1996

Prepared by Egan & Associates, P.C.
2300 N Street N.W.
Washington, D.C. 20037
(202) 663-9200

EGAN & ASSOCIATES, P.C.
Counselors at Law

DOE's RECORD OF DECISION ON TRITIUM SUPPLY:

FATAL FLAWS IN THE ENERGY DEPARTMENT'S ENVIRONMENTAL IMPACT STATEMENT AND DECISION PROCESS

I. Introduction

On December 5, 1995, the Department of Energy (DOE) released a Record of Decision (ROD) on its Programmatic Environmental Impact Statement (PEIS) evaluating tritium supply and recycling alternatives for the nations's remaining nuclear weapons stockpile. The ROD announced the Secretary's decision to pursue a dual-track program to develop "the two most promising" tritium supply alternatives.[1] DOE's mandate is to be able to produce required amounts of tritium no later than the year 2011, and possibly several years earlier.[2]

Although DOE conceded that commercial nuclear reactor options offer the greatest potential for meeting the nation's tritium supply needs in a timely and cost effective manner,[3] under the ROD, the vast majority of federal funding for tritium supply development will go to an as-yet-unproven accelerator system, with the accelerator to be sited at DOE's Savannah River Site in South Carolina. The small remaining fraction of federal tritium supply funds would be spent exploring the purchase of either an existing commercial nuclear reactor or irradiation services from an existing commercial nuclear reactor, the location and availability of which is currently unknown. Within three years, DOE will choose which of the two preferred options will serve as the "primary source" of tritium. The other option would then be pursued as a "backup source."

---

[1] ROD at p. 1.

[2] ROD at p. 5.

[3] DOE concluded that "[t]he options of the commercial reactor alternative are the best in terms of schedule, production assurance and cost." ROD at p. 38. Notwithstanding this conclusion, DOE also determined, paradoxically, that for a new facility "the accelerator has the highest probability to meet earlier production requirements because of less regulatory uncertainty." Id. While this latter, unsupported conclusion probably reflects DOE's view of experience with delays in previous nuclear plant licensings, it does not account for, or even acknowledge, several important mitigating factors that would be present with any new reactor built at the Savannah River Site, including (1) the existence of a one-step licensing process under 10 C.F.R. Part 52 and the Energy Policy Act of 1992; (2) the existence of NRC-certified advanced plant designs with substantially higher safety margins; (3) the fact that nearly the entire Emergency Planning Zone for a new reactor sited at Savannah River would be on federal land; and (4) the fact that the state and local communities have voiced, verbally and in writing, very strong support for the reactor. In contrast, DOE's belief that the accelerator is free of regulatory obstacles ignores (1) the likelihood that the accelerator

DOE rejected the option of building a new reactor to produce tritium. DOE also rejected an industry-proposed project for a Multipurpose Reactor, a privately-built and privately-financed nuclear power plant that would simultaneously produce all of the nation's needed tritium, consume all of the nation's excess plutonium from dismantled nuclear warheads, and generate up to 1350 megawatts of electricity to be sold in the Southeast regional electric marketplace as an independent power project. In particular, DOE rejected a specific proposal by a consortium of reputable nuclear suppliers to build a fully-designed and NRC-approved advanced nuclear energy plant. That same plant design has been offered on a fixed-price basis in recent overseas competitive solicitations.

DOE based its decision to choose the accelerator option over the new reactor options in large part on its conclusion that the accelerator "has the least environmental impact because it does not use fissile material, generates no high-level wastes, and while the risk from a severe accident is very small for all of the alternatives, the risk for the accelerator is the smallest."[4] According to DOE, an accelerator "has the lowest estimated environmental impacts" of any new facility alternative.[5]

Unfortunately, DOE's conclusion that the accelerator has the "lowest estimated environmental impact" is both legally and factually incorrect. Moreover, DOE's errors are not subtle, but glaring. As discussed in detail below, DOE's environmental analysis ignored key requirements of the National Environmental Policy Act (NEPA) and federal

---

will also be regulated by NRC and require NRC licensing; (2) that, unlike the case for advanced reactors, NRC has no current procedures, guidelines, or resources for licensing the accelerator; (3) that intervenors opposed to tritium or weapons production are unlikely to care how tritium is produced; and (4) that DOE's last two accelerator projects (the Los Alamos accelerator and the Superconducting Supercollider) were undone in large part for institutional reasons, including court intervention that halted the Los Alamos accelerator project.

[4] ROD at p. 38.

[5] ROD at p. 39.

regulations implementing NEPA, as well as longstanding U.S. Supreme Court precedents interpreting NEPA and specifying precise instructions for assessing the environmental impacts of spent nuclear fuel production. Indeed, in comparing the accelerator option with alternatives, DOE completely ignored the accelerator's largest environmental impacts -- those stemming from the supply of up to 600 megawatts of electricity that DOE has determined will be needed to power the accelerator.[6] This is equivalent to ignoring the environmental impacts of an entire medium-sized baseload coal-fired power plant, a very large combined-cycle gas-fired power plant, or some combination of the two.

During the public comment period on the Draft PEIS, a written comment was provided to DOE which noted the draft document's failure to assess the environmental impacts of electricity generation for the accelerator in comparing the accelerator to alternatives.[7] This comment was discussed at length in at least one of the public meetings held by DOE on the Draft PEIS. Thus, although DOE was aware of this deficiency, the Final PEIS continued to ignore it.

By publishing a PEIS and ROD that are deficient as a matter of law, DOE has left the nation's tritium supply vulnerable to legal challenge at any time. Because NEPA does not contain a statute of limitations specifying when legal challenges to an EIS must be mounted, or when such challenges can no longer be made, would-be challengers are afforded on open-ended opportunity for attack.

Thus, for example, challengers opposed to maintaining any nuclear weapons in the nation's stockpile can wait until the accelerator is irrevocably underway and then file a simple, low-cost complaint in federal district court seeking to enjoin its continued construction on grounds that NEPA has been violated by DOE. Such challenges are routinely brought against DOE, and frequently the challengers have prevailed. No expensive trial would be required in such an action; the court would examine DOE's actions simply as a matter of law, as does this memorandum.

---

[6] See PEIS at Vol. I, p. 4-476. Although the PEIS recognizes that the power source could be up to 600 megawatts in size, the ROD specifies a range of 350- to 550-megawatts for a range of tritium production levels. The lower value applies to a steady-state production rate of 3/16 of the goal amount previously established by DOE's New Production Reactor (NPR) program. The latter value applies to 3/8 of the NPR goal. ROD at p. 5. (To cover contingencies, DOE would likely be required to purchase at least 550 megawatts of capacity, even if steady state production required only 350 megawatts of energy.)

[7] PEIS at Vol. III, pp. 2-98 and 2-143.

As a matter of law, DOE's tritium supply ROD is highly likely to be viewed in court as a NEPA violation, potentially entitling challengers to injunctive relief that could jeopardize DOE's exclusive responsibility to meet the nation's tritium supply needs in the required time frame. This, in turn, imperils the nation's remaining nuclear weapons stockpile. Given the history and nature of the issues involved, any potential fix could then require a significant amount of lead time to implement -- especially if DOE is required by the courts to terminate one project and pursue another one using different technology.

II. Discussion

A. In Evaluating Tritium Supply Options, DOE Established a Flawed and Biased Set of Environmental Discriminators and Ignored the Impacts of the Accelerator's Immense Power Supply Source

According to the ROD, "[t]he environmental impacts reported in the PEIS were evaluated for discriminators among tritium supply technologies and among sites."[8] In fact, however, DOE's selection of such discriminators is fatally biased in favor of the accelerator, since all impacts from the accelerator's immense power supply were ignored in the comparative analysis, and all impacts associated with nuclear reactors were significantly and improperly aggrandized. As discussed in detail in subsequent sections, DOE's approach runs counter to NEPA and to longstanding U.S. Supreme Court precedent.

DOE determined that there are only "three environmental impacts that differentiate among the tritium supply alternatives: spent fuel generation, low level radioactive waste generation and risks from severe accidents."[9] All three of these penalize any new reactor option. DOE acknowledges, but does not evaluate, the "additional" discriminator associated with "the need for or generation of electricity."[10] In a table in the ROD comparing impacts on the basis of environmental discriminators, the latter two are ignored.[11] The only "waste discriminators" listed by DOE are those which penalize nuclear reactors.

---

[8] ROD at p. 16.

[9] ROD at p. 23.

[10] Id.

As even DOE appears to recognize, there are important additional environmental discriminators, including other bona fide "waste discriminators," that are completely missing from DOE's comparative quantitative environmental analysis, all of which weigh against the accelerator and in favor of a new nuclear reactor. Although DOE's PEIS discusses many of these impacts qualitatively,[12] there is no quantitative comparison of the impacts on the basis of any widely-used and common measure (e.g., cost, early fatalities, risk of loss, etc.) Yet, DOE does do such a comparative quantitative analysis when the results weigh against nuclear reactors, and this skewed analysis forms the basis for DOE's decision to select the accelerator as a preferred alternative over a new reactor.[13]

Altogether missing from DOE's quantitative comparison are evaluations of the following environmental impacts that would be associated with the accelerator's power supply:

- the amounts of additional sulphur dioxide,[14] oxides of nitrogen,[15] and particulates[16] generated;

---

[11] Id. at p. 18.

[12] See PEIS Volume I, at pp. 4-478 to 4-482.

[13] See ROD at pp. 25 and 16-18.

[14] Estimated to be 3440 tons per year for coal, 5 tons per year for gas, and 0 for nuclear reactors. PEIS Volume I, at pp. 4-478 and 4-480, respectively. The first two of DOE's numbers are those associated with the impacts of a coal- or a gas-fired power plant to power the accelerator, which also form the likely bounds of a network purchase based on a mix of principally fossil-based energy supply from the Southeast regional power grid.

[15] Estimated at 8600 tons per year for coal, 314 tons per year for gas, and 0 for nuclear reactors. PEIS at pp. 4-478 and 4-480.

[16] Estimated to be 293 tons per year for coal, and 0 for nuclear reactors. PEIS at Volume I, p. 4-478.

- the amounts of additional carbon dioxide (greenhouse gases) generated;[17]
- the amounts of additional carbon monoxide generated;[18]
- the amounts of additional volatile organic compounds generated;[19]
- the amounts of additional solid pollutants (e.g. ash or waste oil) generated;[20]
- the cancer risks from additional pollutants generated;[21]
- the groundwater quality degradation occurring;[22] and,
- the additional construction impacts associated with the power plant.[23]

Although the PEIS qualitatively recognized several of the above environmental impacts resulting from the accelerator's power source, these impacts were utterly ignored by DOE in comparing and selecting preferred alternatives.[24] DOE did not specify, and did not use, any selection criterion whatsoever for its selection of environmental discriminators.

---

[17] Not evaluated at all in the PEIS, although significant quantities are created for both coal and gas options, and none for nuclear reactor options.

[18] Estimated at 2,219 tons per year for coal, 75 tons per year for gas, and 0 for nuclear reactors. PEIS at Volume I, pp. 4-478 and 4-480.

[19] Estimated at 215 tons per year for gas, and 0 for nuclear reactors. PEIS at Volume I, p. 4-480.

[20] Not evaluated in the PEIS, although DOE recognized that the coal option would use 1,853,000 tons of coal per year, and that the gas option could use substantial amounts of No. 2 fuel oil. PEIS at Volume I, pp. 4-478 and 4-480.

[21] Not evaluated in the PEIS for coal and gas options, although it is analyzed for nuclear reactor options.

[22] Not evaluated in the PEIS, although it is mentioned qualitatively. PEIS at Volume I, Chapter 4.

[23] Not evaluated in the PEIS for coal and gas options, except qualitatively. PEIS at Volume I, pp. 4-477 and 4-479.

For example, in evaluating comparative cancer risks, DOE concluded with no quantitative analysis that the accelerator "clearly has a significantly lower cancer risk than any of the new facility reactor alternatives."[25] DOE therefore concluded that "cancer risk is considered a discriminator between the [accelerator] and new reactor alternatives for the purposes of this decision."[26] But DOE's comparative cancer analysis failed to evaluate at all the well-documented cancer risks (e.g. lung cancer) from the various pollutants associated with any 600-megawatt increase in production of fossil-based energy. These impacts were simply presumed to be of no significance. Then, taking the minuscule cancer risk associated with the one-in-ten-million chance of a severe nuclear plant accident from an advanced light water reactor, DOE concluded that, on the basis of cancer risk, the accelerator is preferred. This flawed and biased methodology is contrary to NEPA, and would not survive any parallel state regulatory review process that a utility's integrated resource plan must go through before a state's public utility commission.

Similarly, while recognizing most of the apparently significant air quality impacts that would be associated with procuring up to 600 megawatts of electricity for the accelerator, DOE qualitatively dismissed these impacts in its comparative analysis, concluding sua sponte that "the air quality impacts of all technological alternatives at all sites are very low."[27] Therefore, air quality -- the key environmental discriminator in virtually every state's and every utility's integrated resource plan -- was rejected by DOE as being an inappropriate discriminator for purposes of evaluating tritium supply options. Although DOE states that the "environmentally preferable alternative is the alternative that would cause the least impact to the physical environment, and best protect worker and public health,"[28] DOE ignored those impacts having the largest effect on worker and public health.[29]

---

[24] DOE states simply, and incorrectly, that "[t]he potential impacts of a gas-fired electrical generation plant were incorporated into the environmental analysis" for the accelerator's site. ROD at p. 17.

[25] ROD at p. 17.

[26] Id.

[27] ROD at p. 23.

Paradoxically, DOE recognized that building and operating a dedicated power plant would produce impacts "to air resources, land use, soils, biotic resources, and socioeconomics at the construction site."[30] DOE also recognized that operation of a dedicated power supply, or increased electrical demand on the power pool, would result in increased impacts to air resources, water resources, waste management systems, and local traffic," as well as "impacts to land use, soils, waste management systems, and biotic resources ... at the plant location and along the transportation system supplying the coal or gas to the power plant."[31] Yet, none of these recognized impacts were viewed by DOE as appropriate discriminators for comparatively analyzing tritium supply alternatives.

DOE blames its failure to comparatively weigh power supply impacts on the mere fact that it is currently unable to decide whether it will build a dedicated power plant for the accelerator or attempt to purchase up to 600 megawatts of electricity from a regional power supply network.[32] Thus, DOE erroneously concludes that it can defer any full analysis of the accelerator's environmental impacts to that time at which a "site-specific NEPA review" is undertaken.[33] While the environmental impacts of the accelerator's power source were qualitatively recognized by DOE in the PEIS, DOE stated that "no decision regarding a preferred source of power is appropriate at this time."[34] According to DOE, "the site-specific NEPA review would more fully explore the options of providing power to the accelerator, and the appropriate decision would be made at that time."[35] Thus, "the environmental impacts that could be avoided" by selection of a new reactor alternative are only "discussed qualitatively in the Final PEIS."

---

[28] ROD at p. 33.

[29] For example, an Environmental Protection Agency study comparing health effects of coal-fired power plants with those for nuclear power plants has documented risks of 0.7 to 3.7 major health effects per 1000 megawatts per year for coal, but only 0.03 to 0.05 major health effects per 1000 megawatts per year for nuclear. According to the study, "for the general public the health risks from the coal cycle are about 50 times greater than for the nuclear cycle" for each 1000 megawatts of power generation. See Edward P. Radford, M.D., "Impacts on Human Health From the Coal and Nuclear Fuel Cycles and Other Technologies Associated with Electric Power Generation and Transmission," prepared for the Office of Research and Development, U.S. Environmental Protection Agency (1980).

[30] ROD at p. 35.

[31] Id.

[32] ROD at p. 35. DOE has already selected the Savannah River Site as the site for the accelerator. Integrated resource plans and load projections are on file for each of the utilities in the Southeast regional electric marketplace that would be fed from Savannah River Site. Thus, it should have been easy for DOE to determine that, during the relevant time period (e.g., 2011 and beyond), the accelerator will be purchasing power

In fact, DOE evaluated only a segment of the accelerator's environmental impacts, deferring a complete analysis of well-recognized impacts to that time at which an irrevocable commitment will already have been made toward the accelerator, and a much narrower, site-specific Environmental Impact Statement is then undertaken.

As noted above, in analyzing the accelerator segment, DOE arbitrarily chose only "three environmental impacts that differentiate among the tritium supply alternatives: spent fuel generation, low level radioactive waste generation and risks from severe accidents."[36] All three of the discriminators weigh in favor of the accelerator option, and against reactor options. Where the reverse is the case, the discriminators were altogether dismissed.

This technically flawed and legally impermissible methodology is all the more unfortunate since, as DOE recognizes,[37] a new reactor would produce, not consume, up to 1350 megawatts of power, and thus would displace the need for 1350 megawatts of largely fossil-based power production elsewhere, in addition to avoiding having to procure

---

in a region with a significant demand for new baseload and new intermediate resources. The accelerator will exacerbate any shortfall in the region. Since the accelerator will not be purchasing excess generating capacity, the environmental impacts of its power supply will be 100-percent marginal, and of equal environmental significance as would be any 600-megawatt increase in regional demand in the relevant time frame.

[33] Id.

[34] Id.

[35] Id.

[36] Id.

[37] ROD at pp. 16-17.

550 megawatts of capacity for the accelerator. Therefore, in comparing the accelerator with a new reactor, the real environmental impacts of the accelerator are those associated with the supply of up to 1900 megawatts of power -- the size of a large, dual-unit state-of-the-art coal-fired power plant, or the size of two of the largest-ever combined cycle gas-fired power plants. In short, the already-significant air quality impacts listed in the PEIS for the accelerator's power supply combine with the avoided impacts (or credits) associated with the new reactor option, and are in fact triple what DOE has stated. To claim, as DOE does, that it need not factor these enormous air quality, waste, and land use impacts into its environmental comparisons at this time because a site-specific NEPA review will conduct the evaluation sometime in the future defies common sense and well-established legal precedent.

To then perform an environmental impact comparison only on the basis of the small and/or legally insignificant impacts associated with spent fuel, severe accident risk, and low-level radioactive waste and conclude that the accelerator is environmentally preferred is facially arbitrary and capricious, and appears to reflect a high degree of bias against nuclear energy.

B. DOE's Segmentation of the Accelerator From Its Required Power Supply is Legally Impermissible Under NEPA

The existence of the Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling confirms DOE's view -- a correct view under NEPA -- that the tritium supply program, including the proposed construction and operation of an accelerator, is a "major federal action significantly affecting the quality of the human environment" and requiring an Environmental Impact Statement (EIS).

An important feature of any EIS is that it consider all essential and relevant connected actions that are interdependent parts of the larger proposed action. In other words, agencies may not artificially reduce the environmental impact of a proposed action by "segmenting" a portion of a project and evaluating only the impacts of the segment.

Yet, that is precisely what DOE did in analyzing the accelerator. DOE segmented the accelerator from the immense power supply that will be required to operate it, thereby artificially reducing the accelerator's environmental impacts vis-a-vis new reactor options. Ironically, as noted below, there exists a plethora of federal cases prohibiting such segmentation, some of which evolve out of prior NEPA lawsuits brought against DOE.

To assist agencies in undertaking environmental reviews, Congress created the Council on Environmental Quality (CEQ) and charged it with developing methods and procedures for use by federal agencies in implementing NEPA. See 42 U.S.C. §§ 4332(2)(B) and 4342. CEQ subsequently promulgated such regulations, including regulations pertaining to development of an EIS. See 40 C.F.R. §§ 1500-1508. DOE has formally adopted the CEQ regulations for purposes of DOE's implementation of NEPA. See 10 C.F.R. Part 1021.

Under CEQ regulations, the scope of an EIS is to be determined by considering a range of types of actions, alternatives, and impacts. 40 C.F.R. § 1508.25. Included in the types of actions to be evaluated must be those "connected actions" which are "closely related" to the overall project and which should properly be considered in a single EIS. 40 C.F.R. § 1508.25. Actions are "connected" under NEPA if they:

> (i) Automatically trigger other actions which may require environmental impact statements.
> (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.
> (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

Id. at § 1508.25(a)(1). The accelerator and its power supply meet each of the CEQ's requirements for "connected actions." First, building an accelerator automatically triggers the need to obtain up to 550 or 600 megawatts of power, a solicitation which alone (and unquestionably) requires, and has always required, an EIS. This is all the more true in the rapidly-growing Southeast regional electric marketplace, where studies have shown a large projected need for new baseload electric capacity by the year 2011.[38] In other words, DOE will not simply be purchasing excess electric capacity from a regional system awash in power, but will in fact be adding to a serious projected capacity shortfall.

This contrasts with any new reactor option, which would reduce regional needs for additional new generating capacity by up to 1350 megawatts. Whether DOE meets the accelerator's power demand by building a new power plant or by compelling the regional marketplace to build an additional 550 or 600 megawatts, the environmental impacts will be those commonly associated with a new plant, or with a mix of equivalent new fossil capacity built elsewhere. These impacts are significant, and, as explained above, are not difficult to analyze. Utilities commonly analyze such impacts in their integrated resource plans filed with state utility commissions.

---

[38] Based on filed integrated resource plans as of 1993, Florida, Georgia and the Carolinas were together projected to have a 21,000-megawatt capacity shortfall by the year 2011.

Second, construction of the accelerator cannot proceed or be completed unless a power supply source for the accelerator is found. Without such a power supply, the accelerator will not operate.

Third, the accelerator and its power supply are interdependent. One cannot or will not exist without the other. Both the accelerator and its power supply are in fact "proposed" actions under active consideration by DOE. This is not a case where DOE can build the accelerator and then make a later decision on whether or not to provide the power to run the facility. The existence of the accelerator necessitates the existence of the power supply.

In sum, the factual circumstances cause the power supply to meet each of the regulations' definitions of a "connected action" required under NEPA to be evaluated in a single, comprehensive EIS.

Courts have looked to specific factual circumstances to determine whether two actions are so connected and interdependent that separating them would constitute impermissible segmentation under NEPA. The U.S. Supreme Court, in examining the scope of an EIS and whether segmentation has occurred under NEPA, has held that "when several proposals for ... actions that will have cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together." Kleppe v. Sierra Club, 427 U.S. 390, 409-10 (1976). "Only through comprehensive consideration of pending proposals can the agency evaluate different courses of action." Id. at 410.

Under the "rule against segmentation" (40 C.F.R. § 1508.27(7)), dividing a larger project into smaller parts in order to avoid or influence the results of an EIS has been recognized by the courts as improper under NEPA. Following the principles outlined by the U.S. Supreme Court in Kleppe, the Fourth Circuit examined segmentation and held that an administrative agency should consider the impact of related proposed projects "if the projects are so interdependent that it would be unwise or irrational to complete one without the others." Webb v. Gorsuch, 699 F.2d 157, 161 (4th Cir. 1983). In the Webb decision, the court reached a determination that segmentation had not occurred, but only because one action did not in fact represent a "practical commitment" to the other. Id. at 161. In the case of tritium supply, committing to the accelerator specifically represents a "practical commitment" to building or purchasing up to 600 megawatts of electric power.

Courts nationwide have addressed various aspects of segmentation under NEPA. In 1979, a federal district court ruled that "secondary impacts" such as those induced by increased air and noise pollution, changes in land usage, and increased demands on gas, water, and sewer utilities are required to be considered in an EIS. Monarch Chemical Works, Inc. v. Exon, 466 F. Supp. 639 (D.C. Neb. 1979). The accelerator's power supply falls squarely within the parameters of this case.

Other courts have ruled that NEPA prohibits segmentation which operates to reduce artificially a project's environmental impacts. In a case specific to DOE, the District of Columbia federal district court found that under Kleppe, "the crucial issue is whether the various agency actions, when combined, have an effect on the environment that might be overlooked if examined separately; agencies cannot be permitted to "segment" their proposals for actions in a manner that disguises their environmental effects." Sierra Club v. Watkins, 808 F. Supp. 852, 863 (D.D.C. 1991). See also, City of Rochester v. U.S. Postal Service 541 F.2d 967, 972 (2d Cir. 1976) (permitting NEPA reviews to be segmented would "provide a clear loophole in NEPA").

C. DOE's Appraisal that Spent Fuel Production is a Critical Environmental Discriminator is Directly Contrary to U.S. Supreme Court Precedent Interpreting NEPA

DOE's appraisal that "spent fuel generation" should be treated as a critical environmental impact that "differentiate[s] among the tritium supply alternatives" is also factually incorrect.[39] More importantly, DOE's conclusion in this regard is also wrong as a matter of law.

In licensing nuclear power plants, the NRC has grappled extensively and repeatedly with how to evaluate the environmental impacts of spent nuclear fuel generation and other aspects of the back end of the nuclear fuel cycle. As early as 1976, the NRC proposed an interim rulemaking proceeding that acknowledged that the risks from long-term storage (including repository failure) were uncertain, but that research would resolve most of those uncertainties. 41 Fed. Reg. 45850-45851 (1976). After further proceedings, the NRC promulgated the interim rule in March 1977. 42 Fed. Reg. 13807 (1977). This was followed, after extensive hearings, by a final rule on evaluating spent nuclear fuel in 1979. 44 Fed. Reg. 45362 (1979).

---

[39] ROD at pp. 23-24.

In a landmark case, the U.S. Supreme Court held in 1983 that the Nuclear Regulatory Commission (NRC) was entitled to presume (and that licensing boards must assume) that, for purposes of NEPA, the permanent storage of spent nuclear fuel from a single nuclear reactor -- as well as all radiological hazards and effluents associated with the nuclear fuel cycle -- will not lead to releases and will have no significant environmental impact. Baltimore Gas & Electric Co. v. Natural Resources Defense Council, et al., 462 U.S. 87 (1983). See also, Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, 435 U.S. 519 (1978). Accordingly, the Supreme Court deferred to NRC's extremely detailed generic spent fuel analysis, summarized in a well-known table referred to as "S-3." See 462 U.S. at 109.

In particular, the Supreme Court upheld NRC's view, expressed in a generic rule, that the long-term or permanent storage of spent nuclear fuel should not affect the decision in a NEPA analysis of whether to propose and license a nuclear power plant. 462 U.S. at 90. According to the Supreme Court, the generic "zero-release" rule chosen by NRC to evaluate spent fuel impacts "is clearly an appropriate method of conducting the 'hard look' required by NEPA." 462 U.S. at 101. In affirming the NRC, the Court viewed "as 'naive' the notion that the fuel cycle effluents could tip the [NEPA] balance in some cases and not in others." 462 U.S. 105, citing 44 Fed. Reg. 45374 (1979). Accordingly, the Court upheld NRC's view that "no further discussion" of the environmental impacts of spent nuclear fuel was necessary in a NEPA analysis of a new nuclear power plant. 462 U.S. at 107.

In 1990, the NRC concluded a series of additional public hearings on the nation's nuclear waste disposal program, often referred to as NRC's "Waste Confidence Decision Review." See 55 Fed. Reg. 38474 (1990). DOE actively participated in this docket, and supported NRC's determination that sufficient confidence exists in the technological, political, and financial feasibility of the repository so as not to undermine NRC's previous conclusions that no significant environmental impact will result from long term storage and disposal of spent nuclear fuel. See 55 Fed. Reg. at 38475-77.

In responding to questions about the tritium PEIS, DOE's analysts have said they were unaware of the Supreme Court's Baltimore Gas & Electric decision. Apparently DOE also ignored its own active support of NRC's Waste Confidence Decision Review. Hence, DOE erroneously presumed, with no technical analysis, that the environmental impacts of the incremental amount of spent fuel from a new reactor are significant enough to be a critically important so-called environmental discriminator in the PEIS. This presumption flies in the face of Supreme Court precedent and many years of successful nuclear plant licensing proceedings and their associated NEPA documentation.

Ironically, DOE proposes to increase the institutional burdens on a new reactor by voluntarily subjecting the licensing of such a reactor (apparently even if sited on a federal reservation like the Savannah River Site) to NRC jurisdiction.[40] But this would render DOE's analysis of the spent fuel impacts of such a new reactor not only technically nonsensical but prohibited under applicable NRC rules and Supreme Court precedent. DOE cannot have it both ways; either its analysis of regulatory obstacles has unfairly penalized new reactors, or its analysis of the allegedly critical environmental discriminator has unfairly penalized new reactors. In either case, a correct analysis would alter DOE's conclusion that the accelerator option is preferred over any new reactor option.

E. Conclusion

DOE's PEIS on tritium supply and recycling appears to contain a legal time bomb that any challenger with extremely modest funds may detonate at any future time simply by filing a short complaint in federal district court. Under NEPA, challengers who successfully demonstrate that DOE impermissibly segmented its environmental analysis of a project are entitled to injunctive relief, which could take the form of temporary or permanent cessation of the accelerator project until the PEIS has been redone correctly. Challengers can also show that DOE's PEIS -- aside from its numerous technical flaws not addressed in this memorandum -- is arbitrary and capricious as a matter of law, and contrary to explicit U.S. Supreme Court instructions.

---

[40] "[I]n considering scenarios that involved regulatory delay, the Department used the NRC regulatory process and structure as the basis for this consideration, and assumed that an NRC license would be obtained for construction and operation of the reactor technologies." ROD at p. 20.

UNITED STATES HOUSE OF REPRESENTATIVES

104th Congress

Second Session

NATIONAL SECURITY COMMITTEE

Subcommittee on Military Procurement

Statement for the Record

Inertial Confinement Fusion at the University of Rochester

submitted by

Robert L. McCrory
Professor and Director
Laboratory for Laser Energetics
UNIVERSITY OF ROCHESTER
250 East River Road
Rochester, NY 14623-1299

March 1996

Summary and Requested Action

The Department of Energy's (DOE) Defense Programs' strategy relies on maintaining the technology infrastructure and core competencies to insure that the U. S. nuclear deterrent is credible while contributing to the U. S. research base. The National Inertial Confinement Fusion (ICF) program plays a central role in the stockpile stewardship technology program with the threefold laboratory mission: (1) To demonstrate the ignition of small masses of thermonuclear fuel, (2) To provide access to physics regimes of interest in nuclear weapon design and to provide nuclear-weapons-related physics data, and (3) To provide an above-ground simulation capability for nuclear weapons studies and effects. With cessation of underground nuclear tests and contraction of the nuclear weapons research and development effort, ICF is a vital component of the DOE's technology-based stockpile stewardship program. A potential long-term benefit is that ICF could provide a source of environmentally acceptable and economically competitive civilian power.

The University of Rochester's Laboratory for Laser Energetics (LLE), a participant in ICF research since the 1970s, is the only ICF program that has been jointly supported by the Federal government, State government, industry, utilities, and a university. At relatively small comparative cost to the government, LLE makes contributions to the National program and transfers technology to the public and private sectors through the training of graduate students and interactions with industry and other Federal laboratories. The facility serves as a National laser users' facility benefiting scientists throughout the country. The OMEGA laser is now the highest power ultraviolet fusion laser in the world.

The Laboratory's prime mission is to validate the direct-drive option for ICF. There is a close collaboration among LLE, Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL) to support the demonstration of ignition and gain in the laboratory, the objective set by the National Academy of Sciences' (NAS) review of the National program in 1990.

Reviews of the Rochester program by the NAS and the Inertial Confinement Fusion Advisory Committee (ICFAC) recommended the OMEGA Upgrade and the potential of direct drive as high priorities in the National program. The OMEGA Upgrade was successfully completed on time, on original budget ($61,000,000 total construction cost), and exceeded all acceptance test criteria (45,000 Joules of ultraviolet light—50% above the 30,000 Joule design specification!). OMEGA is the newest of Defense Programs' facilities. We take pride in having established a new neutron yield record of 100 trillion neutrons. The OMEGA Upgrade is the only facility that can demonstrate the scientific potential of direct drive to provide a modest- to high-gain energy option for the Nation. ICFAC, in its February 1996 report[2] emphasized the priority of conducting cryogenic experiments on OMEGA by FY99. The DOE-approved funding profile in the Cooperative Agreement for the LLE program, for operation of the new facility is shown in the table below.

	FY93	FY94	FY95	FY96	*FY97*
Operations	$15,590,000	$16,498,180	$17,165,770	$18,191,770	***$19,150,770***
Capital	$23,410,000	$8,700,000	$3,600,000	$1,900,000	***$2,000,000***
Total	$39,000,000	$25,198,180	$20,765,770	$20,091,770	***$21,150,770***

To provide the operations support for program deliverables and operation of the OMEGA Upgrade, and maintain the training programs at Rochester, a total authorization and appropriation of $21,150,770 ($19,150,770 for operations, and $2,000,000 for capital equipment) is requested for the University of Rochester for FY97.

Background

Thermonuclear fusion is the process by which nuclei of low atomic weights, such as hydrogen, combine to form higher atomic weight nuclei such as helium. In this process some of the mass of the original nuclei is lost and transformed to energy in the form of high-energy particles. Energy from fusion reactions is the most basic form of energy in the universe; our sun and all other stars produce energy by thermonuclear fusion reactions occurring in their interior. Fusion is also the process that provides the vast destructive power of thermonuclear weapons.

To initiate fusion reactions, the fuel must be heated to tens of millions of degrees. In stellar bodies, containment is possible because of the large gravitational force. On earth, ICF involves the heating and compression of fusion fuel by the action of intense laser or particle beam drivers. There are two approaches to ICF, direct and indirect drive: indirect drive involves the conversion of beam energy to x rays to compress a fuel capsule in an enclosure called a hohlraum; direct drive involves the direct irradiation of a spherical fuel capsule by energy from a laser and may be more efficient energetically than indirect drive. For either approach, if very extreme density and temperature conditions are produced, it is possible to produce many times more energy in these fusion reactions than the energy provided by the drivers.

Inertial Confinement Fusion Program Focus

The 1990 NAS review of the ICF program[1] identified the program priorities that were subsequently endorsed and are being pursued by the DOE. The NAS report states *"The expeditious demonstration of ignition and gain should be the highest priority of the inertial confinement fusion (ICF) program. Adequate funding toward this goal must be assured."*

The NAS report identified the glass laser program as the best path to demonstrate ignition (initiation of a thermonuclear reaction that can be self-sustaining) and propagating thermonuclear burn. A recent independent review completed by the JASONS[3] stated *"The inertial fusion program represents the closest approach we know of to a number of critical parameters in the weapon environment...Naturally we expect continued progress in further evaluating ignition prospects from experiments on Nova and on OMEGA Upgrade, a direct-drive laser facility at the University of Rochester..."*

DOE has accepted the recommendations of the reviews, and substantial progress has been made. Encouraging results from indirectly driven targets from the NOVA facility at LLNL have been obtained. Based on these data ICFAC recommended, DOE approved, and the Congress funded proceeding with the design phase for the National Ignition Facility (NIF). The purpose of the NIF is to demonstrate ignition, propagating burn, and modest gain in the laboratory. The NIF project completion is presently projected to be 2002 if the project is funded and approved as proposed.

LLE is the primary focus in the U. S. for the direct-drive approach to ICF. The NAS report states that direct drive may ultimately prove to be the best approach to ICF and provide the most efficient path to a laboratory-scale thermonuclear capability for both energy research and defense technology needs.

OMEGA is the only facility that can demonstrate the scientific potential of direct drive to provide modest- to high-gain on the NIF.

For several years an extensive collaborative program between LLNL, LANL, and LLE has provided data on basic physics, beam smoothing, and unstable hydrodynamics using available laser facilities, such as NOVA. This collaboration is continuing on the OMEGA Upgrade. The joint effort includes both nuclear weapons physics experiments and ICF experiments. This effort is a key element in the stockpile stewardship technology program. Physics issues for both ICF and weapons issues for the stockpile stewardship program fall into five broad categories: irradiation uniformity, laser energy coupling and transport, laser-plasma interaction physics, hydrodynamic stability, and hot-spot and main-fuel-layer physics. The OMEGA Upgrade and NIF programs are complementary. Figure 1 illustrates the schedule for the glass laser facilities to be used in the National program plan for inertial fusion.

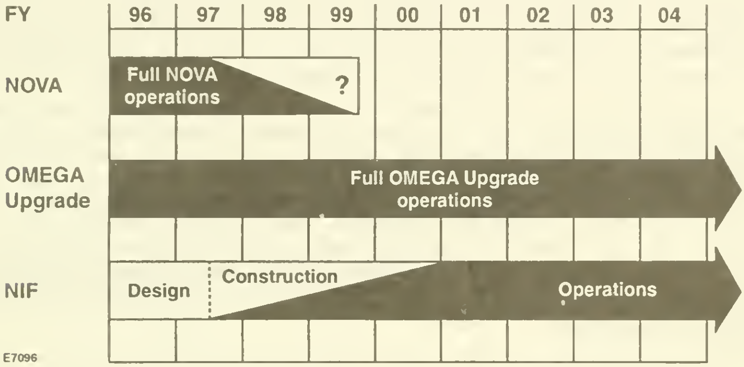


Fig. 1 Schedule for the operation of NOVA, the OMEGA Upgrade, and the NIF.

The figure illustrates how the National program has been structured to provide a full complement of mature experimental facilities from the present to the future. If the NIF adheres to DOE's present schedule, construction of NIF will result in the eventual shut down of the NOVA laser, with **OMEGA as the principal facility to continue experimental work** during the final phases of NIF construction. Although the LLE program is focused on direct drive, OMEGA is capable of indirect drive (hohlraum) experiments as well. Both LANL and LLNL presently plan to use the indirect drive capabilities of OMEGA in the future. An indirect-drive experiment will be conducted on OMEGA during the present (FY96) fiscal year.

The LLE Program for FY97

The OMEGA Upgrade system delivers 45,000 Joules of temporally shaped, ultraviolet (351 nm) light to direct-drive targets. This is the highest energy ever delivered directly to a capsule in a laser-fusion experiment. By comparison, for example, the NOVA capsules are driven with up to 3,000 Joules of energy *($^{1}/_{15}$th as much as direct drive with the OMEGA facility).* The larger energy will yield critical data for ignition-size capsules. Both LANL and LLNL will collaborate with LLE on many of these experiments.

The goal of the glass laser direct-drive target physics program is to evaluate the performance of capsules near ignition conditions. In addition to providing data for the NIF, experiments can validate the direct-drive configuration on the NIF that could result in two to three times higher fusion gains (gain > 50) than those available with the baseline (indirect-drive) NIF design.

An important element of the direct-drive program on the OMEGA Upgrade is to demonstrate beam smoothing techniques that ultimately will produce on-target irradiation uniformity of 1% to 2%. The LLE-developed smoothing by spectral dispersion (SSD) approach was implemented on the OMEGA Upgrade in January of 1996 for precision direct-drive experiments to be conducted later this year. This LLE technique has been implemented on NOVA, and variants of the approach are being incorporated in the NIF design to meet the irradiation uniformity requirements of both direct- and indirect- drive targets.

The development of cryogenic fueling is necessary for the post-NOVA-technical-contract ignition optimization experiments as well as for the hydrodynamically equivalent target experiments to be conducted on the OMEGA Upgrade. In collaboration with LLNL and General Atomics, a prototype cryogenic capability to be completed in FY99 (a change from FY98 due to funding short falls) is being developed for the OMEGA Upgrade. The ICFAC recommended in their final report: *"The committee believes that experiments are essential to assessing real target performance and benchmarking code calculations. The first opportunity to do such experiments on cryogenic targets approaching NIF size will be on Omega...It is very important that this effort be kept on track with proper priority and not delayed further."*[2] Cryogenic capability, advanced diagnostics development, and beam smoothing are all required for the NIF. The OMEGA Upgrade will be the principal National facility to develop these technologies for the program.

LLE attaches a high priority to providing education and training in the field of ICF and related areas. These include theoretical and experimental plasma physics, laser-matter interaction physics, high-energy-density physics, x-ray and atomic physics, ultrafast optoelectronics, high-power laser development and applications, nonlinear optics, optical materials, and optical fabrication technology. A total of 56 graduate students and 19 faculty members of the University of Rochester are currently involved in the unique research environment provided at LLE and represent many departments within the University, including Mechanical Engineering, the Institute of Optics, Physics and Astronomy, Electrical Engineering, and Chemical Engineering. More than 65 undergraduate students receive research experience annually at LLE. A high-school summer science program exposes ten talented students each year to the research environment and encourages them to consider careers in science and engineering. Many LLE graduates have made important scientific contributions in National laboratories, universities, and industrial research centers.

References

1. Review of the Department of Energy's Inertial Confinement Fusion Program Final Report (National Academy Press, Washington, DC, 1990).
2. Inertial Confinement Fusion Advisory Committee Report to Assistant Secretary Reis (February 21, 1996).
3. "Science Based Stockpile Stewardship," JASON Report JSR-94-345 (The MITRE Corporation, McLean, VA, November 1994).

BOSTON PUBLIC LIBRARY
3 9999 05903 637 4

ISBN 0-16-054287-1
90000
9 780160 542879